RCRA Facility Investigation

Perimeter Investigation Report

Prepared for:

The Hoover Company

Voluntary Corrective Action Program
Plant 1, North Canton, OH

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Executive Summary

The Hoover Company (Hoover) has completed the Perimeter Investigation at their Plant No. 1 facility in North Canton, Ohio. Hoover has done this work under a Voluntary Corrective Action Agreement with the United States Environmental Protection Agency (USEPA; signed in October 1999).

The Perimeter Investigation has met the four objectives identified in the investigation planning phases. Data from this investigation:

- Have been used to identify whether site-related chemicals were present at the facility boundary, and where present, determine chemical concentration distribution.
- Are supporting assessments of potential chemical migration and analyses of potential risks to human health or the environment from chemicals identified at the facility boundary.
- Have been and are being used to identify and prioritize areas where additional onsite or offsite characterization is warranted to determine whether migration has occurred.
- Will support evaluation and selection of source control and management measures.

The Perimeter Investigation findings have provided information on physical site conditions and the nature and extent of chemicals present in soil and groundwater along the facility boundary and at the surface of the onsite recreational areas. This information will be combined with existing site information to develop a more complete understanding of the facility, and will be augmented over time, as new information becomes available. Key findings from the Perimeter Investigation are summarized within the following paragraphs.

Overall, the investigation findings indicate that:

- There is no identified, imminent health threat
- There are only limited areas along the perimeter were further evaluation is warranted

Physical Conditions Findings

The facility is located in an area that is both a topographic and bedrock high point in elevation. Topography is generally flat. The primary source of groundwater beneath the site is from rainwater infiltration.

Site surface and subsurface soils are predominantly a fine-grained (silt and clay) or mixed (silts and clays with some sands or gravels) matrix, with lenses or apparently discontinuous layers of coarse-grained materials (sand and gravel). Fill material is occasionally present. Depth to bedrock (which is primarily gray shale, but some coal, sandstone, and siltstone are also present) is generally shallowest (10 to 15 feet) near the central/south-central part of the site and deepest (up to 35 feet) along the west perimeter. The bedrock slopes to form a valley shape beneath the western perimeter.

Groundwater is present in subsurface soil materials throughout the northern portion of the facility and along the western perimeter (where depth to bedrock and the extent of coarse-grained soils are greatest). Groundwater is very limited in the southern portion of the facility (where impermeable surface covers are more predominant, bedrock is shallow and coarse-grained materials are absent or limited in extent). The predominant groundwater flow gradient is to the northwest, where the depth to bedrock and extent of coarse-grained materials are generally greatest. In the northeast part of the site (in the vicinity of the Game Patron parking lot) a component of groundwater flow exists to the north, and appears to be partially controlled by a rise in bedrock elevation across the northern portion of the site. Mean groundwater flow velocities (estimated based on site-specific average hydraulic parameters measured during the Perimeter Investigation) range from approximately 1 to 25 feet per year, with the greatest estimated rates across the western property boundary.

Environmental Quality Findings

Of all the chemical analyses performed in soil and groundwater, roughly one to four percent of the results were at concentrations above Target Levels (which are criteria established based on protection of human health and the environment, approved by USEPA, and below which no further action is typically required by USEPA). Chemical concentrations above Target Levels either have been evaluated further, or are in progress of further evaluations. Findings, however, indicate the following:

- None of the chemicals or concentrations detected represent an imminent threat to human health or the environment.
- Most analytical records have results below target level
  - 99% for soil samples
  - 96% for groundwater samples from borings
  - 99.6% for new groundwater monitoring wells
- Site-wide concentrations and distributions of semi-volatile organic compounds and metals could not be definitively correlated to known activities at the Hoover site. Although some of these chemicals may be associated with site activities at individual locations, these chemicals also can often be associated with naturally occurring background conditions or other sources (such as automobile exhaust). A preliminary assessment of these data suggests that concentrations of these constituents are within ranges typically observed in background or urban environments. Further evaluations of these constituents are in progress.
- Volatile organic compounds detected are consistent with those known to have been historically used at the site. These compounds are no longer in use by Hoover. These chemicals were found primarily in groundwater along the western boundary of the site. Their overall distribution and concentrations are generally consistent with the predominant direction of the groundwater gradient and the presence of saturated coarse-grained soils. Concentrations were representative of dissolved-phase migration in groundwater, and do not suggest the presence of free product at the perimeter.

Additional Evaluation

As mentioned above, the Perimeter Investigation data were used as the basis to identify areas where additional onsite or offsite evaluation is warranted. As a result of this assessment, the following areas were identified for further evaluation:

- The onsite recreational fields, where some additional sampling and data evaluation have already been performed. The results of the evaluation concluded that there is no unacceptable risks to recreational users;
- Groundwater offsite to the west of the facility, where investigation and sampling efforts are already in progress;
- The Game Patron parking lot, where plans for further investigation and sampling are in progress and will be performed in conjunction with onsite investigations; and
- Other individual locations where concentrations of chemicals above Target Levels were identified. Further evaluations at these locations are planned or are in progress to better understand the concentrations observed. These evaluations may range from literature reviews to further sampling and analysis.

Results of these efforts will be documented separately from this report. Additional investigations and necessary corrective action will be implemented as part of the Voluntary Corrective Action process.

SECTION 1

Introduction

This report presents the results of the soil and groundwater sample collection and analysis effort conducted for the Perimeter Investigation at The Hoover Company's Plant 1 facility on East Maple Street in North Canton, Ohio, between November 1999 and February 2000. The investigation was designed to meet the following objectives:

- Identify whether site-related chemicals were present at the facility boundary, and if present, determine chemical concentration distribution.
- Provide data that would allow an assessment of potential chemical migration and support an analysis of potential risks to human health or the environment from chemicals identified at the facility boundary.
- Identify and prioritize areas where additional onsite or offsite characterization is warranted to determine whether migration has occurred.
- Provide data that would support evaluation and selection of source control and management measures.

This report presents the current understanding of physical and chemical environmental conditions at the boundary of the facility, as developed based on the results of this investigation. The physical conditions relate to the nature and distribution of surface and subsurface materials encountered at the facility boundary and include surface topography, surface soil/material type, subsurface soil/material type, and groundwater. The chemical conditions relate to the nature and distribution of chemicals present in soil and groundwater at the facility boundary and include chemical concentrations in surface soils and materials, subsurface soils and materials, and groundwater.

The Hoover Company has completed the Perimeter Investigation as the first part of the RCRA Corrective Action Program being conducted under a Voluntary Corrective Action Agreement with the United States Environmental Protection Agency (USEPA; signed in October 1999). Hoover is planning and implementing its Program activities consistent with USEPA regulations and guidance. The following planning documents were prepared to guide all phases of implementation of the Perimeter Investigation, including sample collection:

- The *RCRA Facility Investigation, Perimeter Investigation Work Plan* (CH2M HILL 1999a) - providing the overall rationale, objectives, plan and guidance for completing the investigation work from start (sample collection and analysis) to finish (reporting).
- The *RCRA Facility Investigation, Perimeter Investigation Sampling and Analysis Plan* (CH2M HILL 1999b) - providing additional detail on the specifics of sample collection and handling methods, including decision flow charts and standard operating procedures.

- The *RCRA Facility Investigation, Quality Assurance Project Plan* (CH2M HILL 1999c) - providing the plan for obtaining analytical data of decisionmaking quality, including laboratory quality assurance/quality control procedure details.
- The *RCRA Facility Investigation, Program Data Management Plan* (CH2M HILL 1999d) - providing detail regarding investigation data handling, storage, and retrieval procedures and processes.

The Perimeter Investigation sample collection and analysis effort was conducted between November 1999 and February 2000. Activities that were performed and relevant information about them are listed below:

- Surface soil (0 to 2 feet below ground surface) samples were collected from 74 deep (greater than 2 feet below ground surface) boring and 25 shallow (0 to 2 feet below ground surface) soil boring locations.
- About 181 subsurface soil samples were collected from the 74 deep boring locations.
- About 65 groundwater grab samples were collected from the same deep soil boring locations. Twenty-seven of the 74 locations were dry, while some of the remaining 47 locations yielded multiple water samples.
- 12 monitoring wells were installed at 9 locations. Nested pairs (a shallow and deep well together) were installed at 3 locations.
- Groundwater samples were collected from 11 of the 12 monitoring wells; one well went dry during the sampling effort.
- The Perimeter Investigation Target Analyte List of 60 chemicals (developed to be representative of site-related chemicals, those chemicals known or suspected to potentially have been associated with Hoover operations) was analyzed at all 99 soil/groundwater sampling locations.
- The Appendix IX list (40 CFR 264, Appendix IX), which includes the Perimeter Investigation Target Analyte List chemicals plus 168 other chemicals was analyzed at 25 of the 99 soil/groundwater grab sampling locations and each of the groundwater monitoring well sampling locations.
- Additional analyses for geotechnical, treatability, and general chemistry parameters were performed at approximately 10 percent of the perimeter locations, in addition to the Target Analyte or Appendix IX list analyses.
- Horizontal and vertical surveying was conducted at the 99 soil boring locations and 12 monitoring well locations.
- Water level measurements were taken in the 12 Perimeter Investigation monitoring wells and 19 pre-investigation monitoring wells or piezometers at the site.
- Hydraulic testing was performed at 11 of the 12 Perimeter Investigation monitoring well locations.
- An ecological habitat and pathway assessment was performed.

- Data evaluation and interpretation was conducted.

The investigation field activities were completed in general accordance with the RCRA Facility Investigation Work Plan and RCRA Facility Investigation Sampling and Analysis Plan. A few activities and procedures were adjusted in the field primarily to address conditions encountered during the sample collection. The adjustments do not affect the integrity or usability of the data resulting from the investigation and are documented in the technical memorandum, "The Hoover Company Perimeter Investigation—Field Modifications to the SAP and SOPs" (CH2M HILL 2000a).

This report represents the culmination of the planning efforts detailed in the various Program documents. The report sections are:

- **Executive Summary**, provides an overall summary of the results of the Perimeter Investigation.
- **Section 1, Introduction,** provides an overview of the Perimeter Investigation objectives, planning, and implementation.
- **Section 2, Physical Conditions,** provides a summary of the Perimeter Investigation results regarding the nature and distribution of surface and subsurface materials encountered at the facility boundary.
- **Section 3, Environmental Quality,** summarizes the investigation results regarding the nature and distribution of chemicals present in soil and groundwater at the facility boundary.
- **Section 4, Summary,** summarizes how the Perimeter Investigation met the planned objectives and presents preliminary site conceptual model components developed from the Perimeter Investigation findings.

Several data packages also were developed to support this report and subsequent Program activities. The data packages contain detailed information and data that were necessary for developing the report. They are contained in Hoover's Program File. The data packages typically consist of a brief cover memorandum explaining the contents and purpose of the package and detailed data sheets, forms, or tables. The following data packages were developed:

- **Soil Boring Drilling and Monitoring Well Construction Logs** (CH2M HILL 2000b) - containing the description of surface and subsurface materials encountered for each sampling location and a description of each monitoring well installed during the investigation.
- **Conceptual Cross-Sections** (CH2M HILL 2000c) - containing draft cross-sections developed during the geological and hydrogeological data evaluation process.
- **Hydraulic Characterization** (CH2M HILL 2000d) - containing the field data and subsequent analysis procedure and results for the monitoring well hydraulic testing.
- **Geotechnical Results** (CH2M HILL 2000e) - containing the geotechnical testing results.

- **Field Data Tables** (CH2M HILL 2000f) - containing the field data (as compared to laboratory analytical data) collected during groundwater sampling and monitoring well installation.
- **Chain of Custody** (CH2M HILL 2000g) - containing the sample chain-of-custody forms. (The forms were completed to document the samples submitted to the laboratory, the analyses requested for each sample, and proper field-to-laboratory-drop-off sample handling procedures).
- **Chemical Data Evaluation** (CH2M HILL 2000h) - containing data output used to evaluate the analytical data and develop the final environmental quality tables.
- **Analytical Data Quality Review** (CH2M HILL 2000i) - containing the laboratory analytical data review results.
- **Ecological Data** (CH2M HILL 2000j) – containing the facility ecological assessment results.

Finally, because some surface soil samples that were taken in onsite recreational areas on the northerly portion of the facility contained a limited number of chemicals at concentrations above Target Levels, further evaluations were performed. The additional evaluations were:

- A preliminary risk evaluation for publicly accessible recreational areas on the facility (documented in a technical memorandum titled, "Preliminary Risk Evaluation – Recreational Areas at Hoover Plant 1, North Canton, OH").
- A follow-up soil and groundwater sampling effort focused in the Dogwood Baseball Fields (documented in technical memoranda titled, "The Hoover Company Dogwood Baseball Fields Additional Investigation" and "Dogwood Baseball Fields Subsurface Investigation").
- An addendum to the preliminary risk evaluation which incorporated the follow-up sampling results (documented in a technical memorandum titled, "Addendum to the Preliminary Risk Evaluation – Recreational Areas at Hoover Plant 1, North Canton, OH").

These technical memoranda have been appended to the Perimeter Investigation Report, and can be found in Appendix A, B and C, respectively.

SECTION 2

Physical Conditions

This section summarizes the physical environmental conditions encountered at the facility boundary during the Perimeter Investigation. The physical conditions relate to the nature and distribution of surface and subsurface materials encountered at the facility boundary and include surface topography, surface and subsurface soil/material types, and groundwater.

2.1 Surface Conditions

2.1.1 Topography

The site can be divided into two general areas based on land use: manufacturing areas and areas used for other purposes. The manufacturing areas extend over the southern two-thirds of the facility. Non-manufacturing areas make up the northern one-third of the facility. The site is generally flat, except for the topographic high at the soccer fields in the northern part of the site, and Parking Lot 3 on the southern edge of the site which slopes to the south (Figure 2-1). Ground elevations in manufacturing areas range from lows of 1,135 feet above National Geodetic Vertical Datum 1988 to highs of 1,160 feet, with surface slopes of 0.01 to 0.05 foot/foot. Ground elevations in the non-manufacturing areas range from lows of 1,140 feet to highs of 1,170 feet, with surface slopes between about 0.01 and 0.21 foot/foot.

2.1.2 Ground Cover

Ground cover, slope, rainfall intensity, and residual soil moisture affect the amount of rainwater runoff generated during storms and the amount of precipitation that infiltrates into the soil. Ground cover includes buildings, asphalt and concrete (parking lots, roads, and sidewalks), gravel and chip-and-seal (constructed of two alternating layers of gravel and asphalt coating) parking lots, and vegetation. Buildings and well-maintained asphalt parking lots act as an impermeable seal, virtually preventing infiltration of water into the ground. Compacted gravel and chip-and-seal parking lots are semipermeable and allow some infiltration. Areas vegetated by grass and trees, particularly flat areas, allow the most rainwater to infiltrate into the soil.

Figure 2-2 shows the distribution of ground cover at the site. The manufacturing areas are covered by buildings, asphalt, chip-and-seal parking lots, and limited grassy areas between buildings and paved areas. Non-manufacturing areas are covered mostly by grass with some gravel parking lots.

Areas with the greatest potential for infiltration are in the non-manufacturing areas to the north and northeast. Gravel and chip-and-seal parking lots and grassy areas between buildings throughout the center of the site are areas of moderate to minor potential infiltration. Large expanses of the center and southern parts of the site are largely impermeable because of the numerous buildings and asphalt parking lots.

2.2 Surface Soils and Fill

Surface soils (soils 0 to 2 feet below ground) encountered in this investigation consist of predominantly fine-grained material (silts and clays) at the northern and western sections of the facility's perimeter. Mixed coarse-grained surficial material with fines was identified at the southern and eastern perimeters (silty sand with gravel, and clayey sand, respectively). The specific ground cover located at each boring location is shown in Figure 2-3. As noted, the surface soil at many locations is covered by asphalt, chip-and-seal, concrete, or buildings.

Various surface and subsurface fill materials were encountered during the investigation (Figure 2-3). Three general types of fill were observed: construction and demolition debris, road base material, and waste material. Construction and demolition debris and waste material fill were frequently mixed with natural soil material (clay, silt, sand and gravel). Construction and demolition debris fill consists of brick, tile, concrete fragments, and related materials. Road base material consists of asphalt and chip-and-seal. The waste material observed consists of plastic, wire, or metal fragments, a soft bluish-white material, black soil, and apparent bottom ash. Waste material fill was encountered at 12 of the 99 sampling locations (Figure 2-3).

2.3 Subsurface Soils

To illustrate the spatial distribution of soil types within the overburden, five interpretive conceptual cross sections were constructed using boring data from the Perimeter Investigation and previously-performed facility investigations. The conceptual cross section locations are identified in Figure 2-4a. Sections are along the north, west, south, east, and through the center of the facility. In each cross section, soils are aggregated into one of three major groupings: coarse, coarse with fines (mixed), and fines. The following groupings were developed from field observations at each boring location.

- Coarse-grained lithology consists of soils classified as sands, gravels, or sands and gravels. Referred to as "coarse" below.
- Coarse-grained with fines lithology consists of sands with silt or clay, sands and gravel with silt or clay, or gravel with silt or clay. Referred to as "mixed" below.
- Fine-grained lithology consists predominantly (greater than 50 percent) of silt or clay and may include some coarse material, such as sand and gravel, within the fine-grained silt or clay matrix. Referred to as "fine" below.

Soil boring and bedrock elevations are summarized in Tables 2-1 and 2-2.

2.3.1 North Perimeter Cross Section

Unconsolidated material is 15 to 20 feet thick along the northern perimeter of the facility (Figure 2-4b). The dominant lithology at the northern part of the facility is the fine deposits interspersed with some coarse and mixed deposits. Where present, these lesser soil components are 5 feet or less thick. The lesser deposits form lenses that are up to several hundred feet wide. The amount of coarse material increases to the west by

Boring 115/MW-15S and MW-15D, where the lithology consists of predominantly coarse and mixed deposits.

2.3.2 West Perimeter Cross Section

Unconsolidated material at the western perimeter of the site ranges in thickness from 20 feet to the north and south to 35 feet at the center, where the bedrock surface drops in elevation forming an apparent bedrock valley (Figure 2-4c). Coarse, mixed and fine deposits form interbedded and discontinuous lenses throughout this section, with individual lenses generally being less than 10 feet thick and several hundred feet wide.

2.3.3 South Perimeter Cross Section

The unconsolidated material along the southern perimeter ranges from 15 to 20 feet thick and follows a steep drop in the bedrock surface to the east (Figure 2-4d). In some localized areas, the soil is less than 10 feet thick where there is a bedrock rise or where the bedrock slope is steep. Mixed deposits form the predominant lithology, with some zones where fine deposits predominate. A few isolated and thin lenses of coarse material exist to the west and the far east.

2.3.4 East Perimeter Cross Section

The unconsolidated material ranges in thickness from less than 10 feet at the bedrock high at the center of the site to 30 feet at the soccer fields (Figure 2-4e). Mixed deposits dominate the lithology, except in the northern area, which is comprised primarily of fine deposits. Throughout the section there are thin and discontinuous lenses of coarse material, which are more prevalent at the bedrock surface than within the fine or mixed matrices.

2.3.5 Center Cross Section

Unconsolidated material ranges from 10 feet thick at the center of the bedrock high to 35 feet in the bedrock valley to the west (Figure 2-4f). Fine deposits dominate the eastern section, with significant areas of mixed deposits. To the west the lithology is dominated by mixed deposits and significant lenses of coarse material. Lenses of fine material interfinger with lenses of coarse and mixed material.

2.3.6 Sitewide

Unconsolidated materials are generally thinnest (10 to 15 feet) near the bedrock high at the center of the site and thickest at the bedrock valley in the west, where deposits are up to 35 feet thick (Figure 2-5). Alternating zones of coarse and fine materials are dominant to the west. The north, east, and south are predominantly fine materials with some interlayering. In the center of the site, the transition from the fines with lenses to interlayered lenses can be identified as the unconsolidated sequence thickens in the bedrock valley.

Fourteen soil samples were collected from nine perimeter borings for physical and geotechnical properties analysis (Table 2-3). The samples ranged from dominantly fine material (clay and silt) to dominantly coarse material (sand and gravel), but most samples collected were fines. In general, the measured density (wet and dry), porosity, and vertical hydraulic conductivity vary within a range but do not appear to correlate to the predominant nature of the sample material (fine or coarse). However, moisture content values for the predominantly fine samples are higher than those reported for the coarse samples. This is probably accounted for by lower average porosity in the coarse samples and possibly some water loss from the coarse samples as they were removed from the boring. The range of porosity values generally correlates with expected values (Freeze and Cherry 1979).

2.4 Bedrock Geology

Bedrock was encountered in 68 of the investigation borings. Boreholes were advanced into the top of the bedrock, thereby making it possible to determine the thickness of the overburden, identify the type of bedrock present, map the contact between the base of the overburden and the top of the bedrock, and determine the approximate shape of the bedrock surface. Up to 30 feet of bedrock was cored at locations MW-15D, MW-21D, and MW-22D, where bedrock monitoring wells were installed. Locations where a sample of bedrock was successfully collected are noted on the boring logs.

The bedrock is predominately a very soft, highly weathered shale (clay) that grades into a more competent shale with less clay. Thirteen borings along the perimeter encountered a less weathered, fragmented, or fractured shale. Seven borings encountered coal, and eight encountered a massive sandstone or siltstone. Three deeper wells were installed into the bedrock. At MW-15D, a soft shale interbedded with a 4.5-foot coal seam was encountered. At MW-21D, 5.6 feet thick coal interbedded by a soft, moderately weathered shale was identified. The shale is underlain by a soft to hard, massive sandstone. At MW-22D, a highly weathered shale grading to a slightly weathered shale interbedded with coal was encountered.

Bedrock surface elevations were calculated from the encountered top of bedrock depth below ground surface and the surveyed boring ground surface elevation. Using these elevations, a bedrock surface contour map was generated (Figure 2-6). There appear to be primary and secondary bedrock highs forming a "V" in plan view that extend across the facility from the southwest to the east-central area to the northwest. The primary bedrock high trends from the southwest to the east-central part of the facility and has an elevation of 1,145 feet. The secondary bedrock high, about 10 feet lower than the primary bedrock high, trends from the east-central part of the facility to the northwest. From the bedrock highs, the bedrock surface elevation decreases to 1,130 feet to the southeast, 1,105 feet to the west, and 1,130 feet to the northeast.

2.5 Groundwater Occurrence

2.5.1 Groundwater Data

Groundwater levels were measured in the 31 site monitoring wells and piezometers on January 27, 2000. Data were collected from 28 wells or piezometers screened in overburden and 3 wells screened in bedrock (see Table 2-4). Of these, nine shallow and three deep bedrock wells were installed during the Perimeter Investigation. The water levels were converted to absolute datum elevations (National Geodetic Vertical Datum of 1988; feet above mean sea level based on mean sea level data during 1980s) by subtracting the water level below the top of the casing from the surveyed casing elevations. Groundwater elevations varied from 1,158.7 feet in PZ-7 to 1,139.9 feet in PZ-4. Saturated soils were encountered in many of the overburden borings advanced during the perimeter investigation and in most of the wells and piezometers. Based on the results of this exercise, groundwater was encountered 5.5 to 23.5 feet below the top of casing for all wells or piezometers, when detected. For shallow wells and piezometers, depth to groundwater ranged from 5.5 to 21.4 feet with an average of about 10 feet. For the deep wells, depth to groundwater ranged from 19.0 to 23.5 feet with an average of about 21 feet.

2.5.2 Groundwater Contour Map

Groundwater elevation data in the unconsolidated materials were used to generate a groundwater contour map (Figure 2-7). The map shows a broad groundwater high in the east-central part of the site that extends from MW-24S toward the southwest near MW-20S and another lesser high in the north near MW-15S. Groundwater contour lines are dashed where perimeter borings were dry, indicating that water table (or saturated soil) conditions do not always exist within the overburden in those areas (some of the borings were dry while others appeared to be saturated). Groundwater contours are not included on the map south of the groundwater high (near PZ-7) because most of the perimeter borings did not yield water during groundwater grab sampling attempts. Here, either the saturated materials are too tight to yield water, water is intermittently present, or the water table is in the bedrock below the base of the overburden/bedrock interface.

The overburden and its shallow groundwater system can be divided into three zones based on groundwater conditions at the facility: one in the northeast, one in the west, and one in the south (Figure 2-8). The boundaries of these zones are based on the location of the probable groundwater elevation highs (or divides) in the groundwater contour map and the groundwater conditions encountered in the zone, as detailed below.

Hydrogeological conceptual cross sections, showing the interpreted water level surface, vertical and horizontal hydraulic conductivities, wells, and well screen intervals, are shown in Figures 2-9a through 2-9e. The locations of the conceptual cross sections are identified in Figure 2-4a. Section locations are similar to the interpreted geological conceptual cross sections and extend along the site perimeter and through the middle of the facility.

The northeast zone is coincident with the Game Patron Parking Lot, the Dogwood Baseball Fields, and the soccer and practice football fields. Groundwater occurs in discontinuous coarse material and mixed material, separated by tight saturated to unsaturated fine deposits (Figure 2-9a). Perched groundwater subzones are common beneath the soccer fields.

Continuous saturated conditions were found within the western zone. The saturated thickness ranges from 5 feet near the groundwater divide to 30 feet along the western perimeter. The saturated zones yielding the most water occur within intermittent layers of coarse material and mixed material separated by a layer of fines (Figures 2-9b and 2-9e).

Within the southern zone, the overburden was found not to be saturated continuously. Groundwater either does not exist in the overburden or exists only in spatially limited pools within bedrock surface low spots (Figures 2-9c and 2-9d). Unsaturated conditions were found in areas with high bedrock elevations. Subzones of perched groundwater were rarely encountered within the southern groundwater zone.

2.5.3 Groundwater Hydraulics

Groundwater flow is controlled by several factors: the continuity and cross-sectional area of the flow zone, the slope of the water table surface (also called the gradient), and the hydraulic properties of the materials through which groundwater can flow. This subsection presents the results of the investigation groundwater hydraulics with regard to flow gradients, the hydraulic properties of the unconsolidated materials, and the probable direction and rates of flow in the saturated overburden at the site.

2.5.4 Groundwater Gradients and Potential Flow Directions

Just as surface water flows from topographic highs to lows, groundwater generally flows from regions of high groundwater elevation toward regions of lower groundwater elevation. When other hydraulic properties are equal, the flow is faster where the slope is steep and slower where it is flat. In overburden consisting of one uniform material, the direction of flow is directly analogous to the direction of the groundwater contour surface. This surface, with its downslope directions and slopes, is referred to as the potentiometric surface, and the slope along that surface is referred to as the hydraulic gradient.

In general, a water table contour high exists at the center of the facility, with lows apparent to the north, west, south (based on spot data), and east. This configuration suggests that most of the groundwater at the facility is derived from rainwater infiltration as opposed to horizontal groundwater flow to the facility from areas outside its boundary.

The horizontal downgradient direction of the groundwater surface or hydraulic gradient at any point in the groundwater system indicates the potential direction of groundwater flow (Figure 2-7) in terms of the materials' ability to transmit water, if all directions of potential flow are equal. However, at this site, all directions of potential flow are not equal because the material in the saturated zone is a mix of soil with varying capacity to transmit water. Therefore, the hydraulic gradient depicted in Figure 2-7 represents the overall direction of the hydraulic driving force or potential within the flow system zones, but it may not be indicative of actual groundwater flow direction within the saturated subsurface at local and specific locations (i.e., the groundwater flow direction at a specific boring). The actual groundwater flow direction is likely locally controlled, based on recharge in the flow zone, the bedrock surface, local geology, and the hydraulic gradient.

A conceptual groundwater flow model (Figure 2-10) is presented to illustrate these concepts. Where the deposits are sufficiently connected and aligned with the horizontal hydraulic gradient, groundwater will flow in the direction of the overall hydraulic gradient. But if the local geology consists of deposits that are not sufficiently connected or not aligned with the groundwater gradient or deposits, then groundwater either will not flow in the direction of the gradient or will not flow at all.

The horizontal direction of the groundwater contour surface in the northeast groundwater zone is to the north and northeast, at a hydraulic gradient magnitude of 0.01 foot/foot. In the western groundwater zone, the surface slopes to the west, also at hydraulic gradient magnitude of 0.01 foot/foot. Because of the lack of continuity between the pockets of saturated conditions within the southern zone, saturated flow does not occur in the overburden in this region of the facility.

The downward vertical hydraulic gradient calculated for the nested well pairs was 0.5 foot/foot at MW-15, 0.4 foot/foot at MW-21, and 1.1 foot/foot at MW-22. Like the horizontal gradient, the vertical gradient represents the potential for vertical groundwater flow. The occurrence and rate of vertical groundwater flow is controlled by the same characteristics as the horizontal flow; that is, the continuity and conceptual cross-sectional area of the vertical flow zone, the vertical hydraulic gradient, and the vertical hydraulic properties of the materials through which groundwater can flow. At the nested wells, the vertical groundwater gradient was downward, indicating the potential for flow from the overburden to the bedrock. The ability of the weathered and more competent bedrock to transmit vertical flow is not currently quantified, although given the nature of the bedrock material encountered, it is expected that vertical groundwater flow either does not occur or occurs only at relatively slow rates. Although the potential for vertical flow exists, the nature of the bedrock materials suggests little to no vertical flow.

2.5.5 Hydraulic Properties

The ability of the material to transmit or conduct water affects groundwater flow. This ability is typically characterized by measuring the hydraulic conductivity of a material. Testing was performed at 11 monitoring wells to determine the horizontal hydraulic conductivity of the saturated deposits in the overburden of the site. The testing, referred to as slug testing, was completed by placing a rod ("slug") of known volume into the well and measuring the change in water levels over time. Analysis of the data was performed using the Hvorslev method of analysis (Freeze and Cherry 1979). Calculated horizontal hydraulic conductivities (Table 2-5) for multiple tests at the wells tested ranged from 0.03 foot to 60 feet per day at the deep wells and 0.03 foot to 4 feet per day at the shallow wells. The results of multiple tests at a well were then averaged to provide an average "expected value" for that well. With one exception (MW-21D at about 20 feet per day), the averages varied from roughly 0.08 feet per day to 3 feet per day.

2.5.6 Groundwater Flow

Groundwater flow can be discussed in terms of discharge through a section across a region (commonly expressed in units of L^3/T where "L" stands for length and "T" for time), flux per unit volume of saturated material (L/T), or velocity of water (L/T) through the open connected spaces. Discharge (L^3/T) is calculated using the Darcy equation:

$$Q = KiA$$

where:

Q	= groundwater discharge (L^3/T)
K	= hydraulic conductivity (L/T)
i	= hydraulic gradient (L/L or -)
A	= conceptual cross-sectional area across which groundwater flows (L^2)

The groundwater discharge rates for the two active flow zones at the facility (Figure 2-11) were calculated using the hydraulic conductivity (Table 2-5), hydraulic gradient (Figure 2-7), and the saturated conceptual cross-sectional area of the groundwater flow system through which water flows (taken from the hydrogeologic sections, Figure 2-9). For the north/northeast zone, using the observed water levels, the average hydraulic gradient magnitude of 0.01 foot/foot, the geometric mean hydraulic conductivity for MW-15S of 0.08 foot/day, and a flow cross-sectional area of 4,590 ft^2 (based on a section length of about 510 ft and an average saturated thickness of about 9ft), yielded a groundwater discharge of 0.02 gallon/minute. For the western zone, using a hydraulic gradient of 0.01, the geometric mean hydraulic conductivity of MW-16S, MW-17S, and MW-18S of 2 feet/day, and a flow area of 16,310 ft^2 (based on a section length of about 770 ft and an average saturated thickness of about 21 ft), yielded a groundwater discharge of 2 gallons/minute. The fluxes (flows per volume of saturated materials) are 8.4×10^{-4} feet/day to the north/northeast and 0.024 foot/day to the west.

Velocities were computed using the values considered to be representative for hydraulic conductivity, gradient, and porosity obtained during the perimeter investigation for each zone. The resulting water velocities were 3×10^{-3} foot/day (1 foot/year) to the north/ northeast; using the average of saturated sample porosity values for borings 109 and 115 (0.28; Table 2-3) and 7×10^{-2} foot/day (25 feet/year) to the west, using the average of saturated sample porosity values for borings 126 and 129 (0.35; Table 2-3).

The equations and protocols for calculating flows, fluxes, and velocities assume that flow occurs through the entire saturated materials to the north and west. The resulting values are reasonable estimates of the average conditions across the sections considered. However, local variations in direction, rate of flow, and water velocity are expected because of the high variability in the materials that make up the saturated overburden at the site.

TABLE 2-1
Summary of Boring Location Survey and Bedrock Data
The Hoover Company

Location	Northing[1]	Easting[1]	Elevations (ft amsl)[1] Ground Surface	Top of Bedrock	Location	Northing	Easting	Elevations (ft amsl) Ground Surface	Top of Bedrock
SB-107	445004.4	2273823.0	1148.34	1129.34	SB-150[2]	442214.2	2272763.0	1156.93	1144.40
SB-108	445015.0	2273694.6	1147.47	1125.97	SB-151	442143.9	2272821.0	1155.26	1133.96
SB-109	445016.5	2273588.8	1147.26	1126.76	SB-152	442247.1	2272951.4	1154.98	1143.08
SB-110	445018.4	2273489.6	1148.05	1127.05	SB-153	442028.7	2273059.6	1145.70	1134.50
SB-111	445016.7	2273376.1	1149.64	1127.84	SB-154	442018.4	2273254.4	1137.61	1126.91
SB-112	445035.8	2273161.1	1152.24	1134.74	SB-155	442012.6	2273494.9	1137.75	1125.25
SB-113	445036.3	2273016.5	1153.52	1136.82	SB-156	442237.0	2273512.4	1150.42	1140.42
SB-114	445043.5	2272901.5	1154.30	1136.30	SB-157	442442.9	2273484.6	1154.27	1144.77
SB-115	445049.1	2272778.0	1155.13	1136.33	SB-158	442535.3	2273484.9	1157.78	1145.18
SB-116	444868.0	2272799.4	1154.28	1140.28	SB-159	442538.4	2273406.1	1156.11	1146.61
SB-117	444751.9	2272776.8	1152.37	1136.17	SB-160	442683.3	2273419.9	1155.46	1145.46
SB-118	444614.1	2272768.2	1149.81	1128.81	SB-161	442811.1	2273428.4	1155.23	1142.13
SB-119	444508.1	2272774.6	1147.30	1132.50	SB-162	442917.0	2273445.0	1155.98	1142.68
SB-120	444464.9	2272709.8	1147.58	1124.88	SB-163	443024.4	2273445.8	1156.52	1141.62
SB-121[2]	444470.5	2272586.8	1145.79	1123.80	SB-164	443029.3	2273328.4	1158.00	1146.90
SB-122	444380.5	2272546.6	1144.62	1119.62	SB-165	443020.5	2273212.3	1158.79	1149.79
SB-123	444220.0	2272386.3	1141.37	1113.57	SB-166	443164.4	2273162.4	1158.85	1144.65
SB-124	444202.6	2272301.6	1141.14	1108.54	SB-167	443161.4	2273023.7	1157.99	1144.99
SB-125	444105.6	2272190.4	1140.53	1109.93	SB-168	443348.8	2273074.2	1156.91	1143.41
SB-126	444048.7	2272098.7	1140.81	1106.81	SB-169	443372.5	2273324.1	1157.98	1150.48
SB-127	443943.8	2272101.0	1139.10	1104.30	SB-170	443554.5	2273609.8	1155.31	1147.81
SB-128[2]	443842.0	2272060.5	1140.87	1105.90	SB-171[2]	443543.8	2273735.8	1153.23	1145.40
SB-129	443836.7	2271990.9	1141.51	1106.51	SB-172[2]	443761.1	2273773.9	1157.75	1145.80
SB-130	443714.9	2271988.9	1142.42	1113.42	SB-173	443995.3	2273802.5	1165.94	1145.44
SB-131	443615.0	2272013.5	1143.02	1122.42	SB-174	444108.4	2273819.7	1165.47	1144.97
SB-132	443390.7	2272051.9	1144.92	1119.42	SB-175	444362.8	2273808.2	1156.06	1141.06
SB-133	443402.7	2272193.7	1145.82	1123.42	SB-176	444482.6	2273832.5	1155.81	1131.81
SB-134	443415.3	2272306.4	1146.84	1121.34	SB-177	444611.9	2273835.2	1154.29	1139.49
SB-135	443290.4	2272320.7	1149.46	1129.46	SB-178	444799.6	2273846.4	1150.93	1138.13
SB-136	443218.7	2272259.5	1150.78	1130.78	SB-179	444904.8	2273845.7	1149.54	1132.04
SB-137	443087.1	2272282.4	1156.01	1133.21	SB-193	444242.8	2273792.0	1168.41	1138.41
SB-138	443012.1	2272280.7	1156.09	1136.19	SB-208	444409.5	2273539.8	1149.88	NE[3]
SB-139	442909.4	2272150.0	1154.61	1136.81	SB-209	444418.1	2273447.7	1148.60	NE[3]
SB-140	442891.9	2272038.3	1154.15	1137.35	SB-210	444279.4	2273418.7	1150.19	NE[3]
SB-141	442764.3	2272054.0	1156.04	1133.44	SB-211	444423.9	2273176.4	1152.54	NE[3]
SB-142	442652.2	2272071.1	1157.81	1137.01	SB-212	444278.6	2273174.2	1149.33	NE[3]
SB-143	442496.8	2272122.5	1159.78	1139.58	SB-213	444412.7	2273066.3	1151.39	NE[3]
SB-144	442506.7	2272221.8	1159.36	1141.06	SB-214	444269.8	2273073.6	1147.41	NE[3]
SB-145	442467.6	2272295.4	1159.91	1146.61	SB-215	444410.8	2272930.6	1149.72	NE[3]
SB-146	442372.6	2272363.4	1160.74	1152.24	SB-216	444263.7	2272953.1	1148.00	NE[3]
SB-147	442295.8	2272376.8	1159.66	1145.46	SB-217	444241.3	2272822.3	1147.59	NE[3]
SB-148	442292.5	2272508.6	1157.11	1142.31	SB-218	444223.3	2272627.8	1145.41	NE[3]
SB-149[2]	442251.6	2272593.3	1156.46	1143.20					

[1]The northing/easting datum is North American Datum 1983 (NAD83). The coordinate system is Ohio State Planar coordinate system, North section.Elevations in feet above mean sea level are based on mean sea level data during 1980's (National Geodetic Vertical Datum of 1988).
[2]Bedrock depths estimated from refusal at base of boring.
[3]NE - Not encountered.

TABLE 2-2
Summary of Monitoring Well Survey and Bedrock Data
The Hoover Company

Monitoring Well Information				Corresponding Soil Boring Information	
Location	Northing[1]	Easting[1]	Ground Surface Elevation[1]	Location	Top of Bedrock Elevation[1]
MW-13S	445015.2	2273564	1147.5	SB109	1126.8
MW-15S	445035.8	2272791	1154.8	SB115	1136.3
MW-15D	445034.2	2272785	1154.9	SB115	1136.3
MW-16S	444476.4	2272560	1145.8	SB121[2]	1123.8
MW-17S	444087.3	2272136	1141.0	SB125/126	1109.9/1106.8
MW-18S	443847.0	2271981	1141.6	SB129	1106.5
MW-20S	442490.1	2272120	1159.8	SB143	1139.6
MW-21S	442141.2	2272820	1155.3	SB151	1134.0
MW-21D	442147.4	2272818	1155.4	SB151	1134.0
MW-22S	443023.6	2273446	1156.5	SB163	1141.6
MW-22D	443018.3	2273446	1156.4	SB163	1141.6
MW-24S	444241.4	2273786	1168.2	SB193	1138.4

[1]The northing/easting datum is North American Datum 1983 (NAD83). The coordinate system is Ohio State Planar coordinate system, North section.Elevations in feet above mean sea level are based on mean sea level data during 1980's (National Geodetic Vertical Datum of 1988).
[2]Bedrock depth estimated from refusal.

TABLE 2-3
Geotechnical Results
The Hoover Company

Boring Location	Sample Interval (ft bgs)	Saturated/ Unsaturated	Bulk Density (pcf) Wet	Bulk Density (pcf) Dry	Moisture Content	Porosity	Vertical K ft/d	Soil Type/Description[1]
SB-109	6–8	Unsaturated	125.8	104.3	20.6%	0.370	2.42×10^{-3}	Gray green, trace black lean clay, trace sand, organics, roots
SB-109	11–13	Saturated	145.2	129.3	12.3%	0.218	3.60×10^{-4}	Gray sandy silty clay, trace gravel
SB-115	0–2	Unsaturated	121.4	100.9	20.3%	0.390	1.10×10^{-1}	Brown lean clay, little sand
SB-115	6–8	Unsaturated	128.4	107.3	19.7%	0.351	1.80×10^{-1}	Brown fine sandy silt, trace gravel, clay
SB-115	9–11	Saturated	128.0	110.0	16.4%	0.335	1.10×10^{-1}	Brown sand with gravel, trace silt, clay
SB-118	2–4	Unsaturated	115.9	96.5	20.2%	0.417	9.00×10^{-2}	Brown trace black sandy silty clay, trace gravel, cinders
SB-122	4–6	Unsaturated	123.6	110.7	11.7%	0.331	2.81×10^{-3}	Brown silty sand, trace gravel, little clay
SB-126	6–8	Saturated	101.1	99.5	1.6%	0.399	$1.05 \times 10^{+2}$	Brown gravel, sandy, little silt and clay
SB-126[2]	6–8	Saturated	144.8	125.7	15.2%	0.240	1.66×10^{-4}	Brown sandy lean clay, trace gravel, coal
SB-129	10–13	Saturated	121.2	95.1	27.4%	0.425	5.13×10^{-3}	Gray silt, little clay, trace sand
SB-129	4–6	Unsaturated	124.4	97.8	27.2%	0.409	1.95×10^{-4}	Mottled gray and orange lean clay, little sand, trace organics
SB-143	4–6	Unsaturated	126.0	104.1	21.0%	0.371	3.29×10^{-3}	Brown silty clay, some sand, trace gravel
SB-151	15–17	Saturated	148.9	133.5	11.5%	0.193	1.18×10^{-4}	Gray clayey sand, little gravel, trace coal
SB-163	11–12	Saturated	134.4	117.1	14.7%	0.292	1.65×10^{-4}	Brown trace gray sandy lean clay, little gravel

1. From testing laboratory.
2. The geotechnical sample for SB-126 was split into two parts by the lab. The first entry is the sample from the bottom 8" of the Shelby tube, the second from the middle 9" of the tube.
3. bgs = below ground surface
   pcf = pounds per cubic foot
   K = hydraulic conductivity

TABLE 2-4
Monitoring Well Groundwater Elevations—January 27, 2000
The Hoover Company

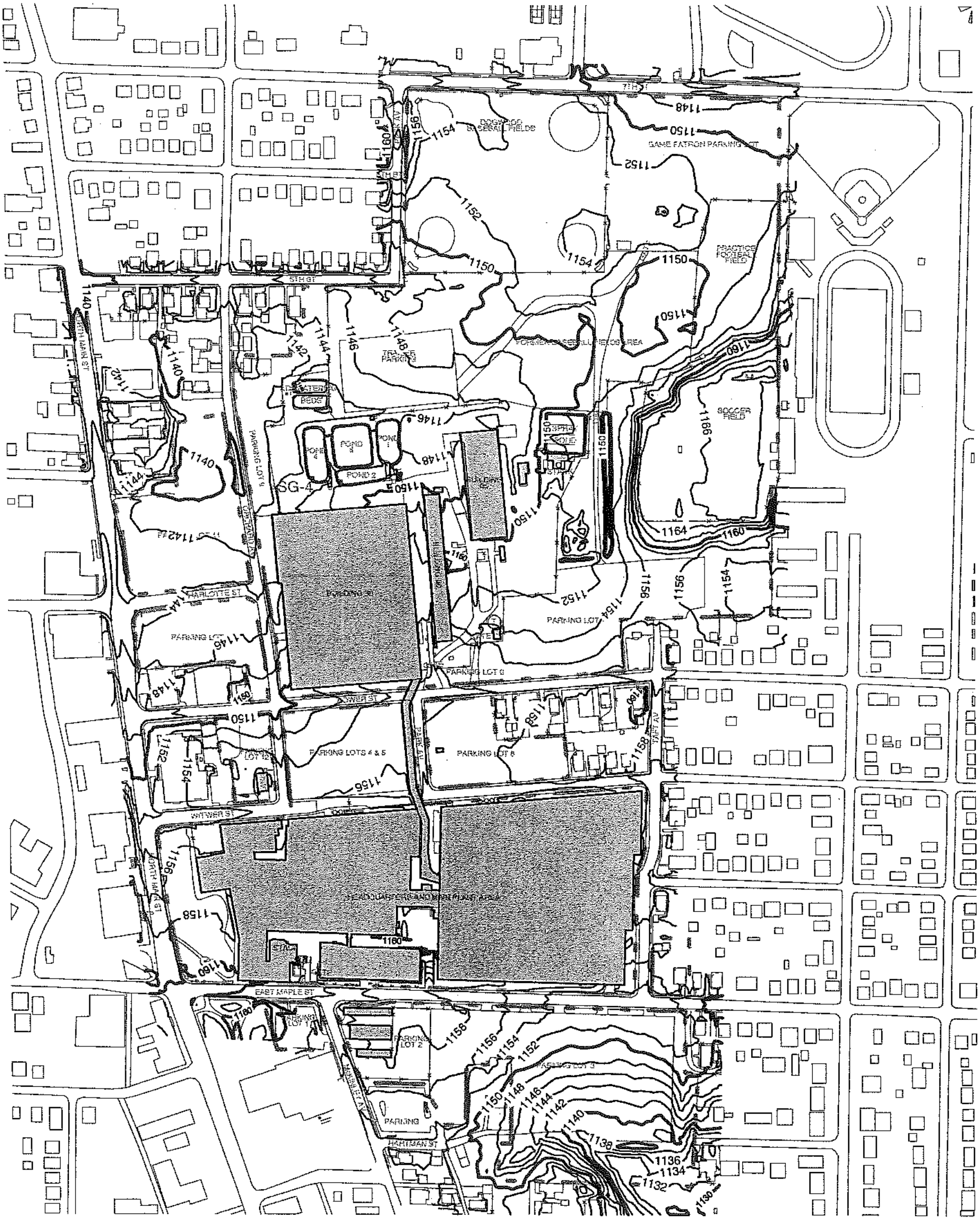
			Groundwater	Elevation (ft)[c]				
Well ID	Northing (ft)a	Easting (ft)[a]	Depth (ft btoc)[b]	Ground Surface	Top of Vault	Top of Casing	Ground-water	Sounded Depth of Well (ft)
MW 1	443388.7	2272875	12.9			1156.6	1143.7	18
MW 2	443442.4	2272936	15.9			1159.3	1143.4	17.6
MW 3	443538.1	2273032	9.1			1152.5	1143.4	15.2
MW 4	443513.9	2272829	11.3			1155.6	1144.3	19.2
MW 5	443615.3	2272886	10.3			1153.9	1143.6	16.8
MW 6	443657.1	2272963	7.9			1150	1142	19.5
MW 7	443679.9	2273033	10.3			1153.1	1142.8	16.9
MW 8	443747.4	2273186	5.6			1150.1	1144.5	14.1
MW 9	443730.5	2272813	11.4			1153	1141.6	18.6
MW 10	443753.2	2272878	8.4			1150.8	1142.4	17.7
MW 11	443824.9	2272937	9.8			1152.5	1142.7	12.9
MW 12	443925.4	2273047	5.5			1148.2	1142.7	14.6
MW 13 S	445015.2	2273564	9.6	1147.5	1147.7	1146.6	1137	15.3
MW 15 S	445035.8	2272791	9.6	1154.8	1154.9	1154.5	1144.9	16.7
MW 15 D	445034.2	2272785	23.5	1154.9	1154.9	1154.5	1131	44.1
MW 16 S	444476.4	2272560	6.3	1145.8	1145.8	1145.1	1138.8	14.8
MW 17 S	444087.3	2272136	6	1141	1141	1140.4	1134.4	14.9
MW 18 S	443847	2271981	7.4	1141.6	1141.6	1141	1133.6	24
MW 20 S	442490.1	2272120	15.8	1159.8	1159.9	1160	1143.8	16.9
MW 21 S	442141.2	2272820	6.7	1155.3	1155.3	1154.3	1147.6	18.3
MW 21 D	442147.4	2272818	19	1155.4	1155.4	1154.9	1135.9	54.1
MW 22 S	443023.6	2273446	7.7	1156.5	1156.5	1155.9	1148.2	14.4
MW 22 D	443018.3	2273446	19.6	1156.4	1156.5	1156.1	1136.5	45.8
MW 24 S	444241.4	2273786	21.4	1168.2	1168.3	1167.5	1146.1	29.7
PZ 1	443287.2	2272326	8.9		1149.6	1149.2	1140.3	9.6
PZ 2	444204.8	2272389	6.4		1141.8	1141.5	1135.1	10.1
PZ 3	444982.1	2273358	12.2		1151.1	1150.7	1138.5	14.6
PZ 4	441997.7	2273446	8.8		1140.3	1139.9	1131.1	10.3
PZ 5	442351.9	2272365	Dry		1160.6	1160.2		8.3
PZ 6	443607.8	2273656	6.7		1154.9	1154.6	1147.9	9.5
PZ 7	443076.7	2273216	8.8	1159		1158.7	1149.9	10

[a]The northing/easting datum is North American Datum 1983 (NAD83). The coordinate system is Ohio State Planar coordinate system, North section.
[b]Groundwater depth below top of casing (btoc) collected January 27, 2000 and measured to the nearest 1/10 foot.
[c]Elevation datum is National Geodetic Vertical Datum 1988, based on mean sea level data from the 1980s.

TABLE 2-5
HYDRAULIC CONDUCTIVITY (K) VALUES
THE HOOVER COMPANY

Monitoring Well	Geometric Mean (ft/d)	Range (ft/d)
MW-13S	*N/A	*N/A
MW-15S	0.09	0.03 TO 0.2
MW-15D	0.08	0.03 TO 0.1
MW-16S	2.2	1.6 TO 2.8
MW-17S	1.9	1.6 TO 2.4
MW-18S	3.1	2.0 TO 4.0
MW-21S	0.1	0.09 TO 0.2
MW-21D	20.7	3.4 TO 56.7
MW-22S	1	1.4 TO 4.5
MW-22D	0.2	0.09 TO 0.3
MW-24S	*N/A	*N/A

NOTES: MW-13S AND MW-24S could not be analyzed, due to poor data results, as a result of water level rising and falling within the screened interval

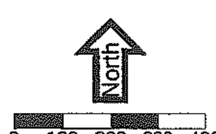


LEGEND

1160 Surface elevation (feet) and contour. Contour interval = 2 feet (every 10 ft contour is bold). Labels are oriented upgradient.

Hoover building

Approximate property boundary



NOTES

1. Ground surface contours were obtained from the orthographic aerial photos taken on 1/17/00 and reference National Geodetic Vertical Datum of 1988 (NGVD88).
2. Base map derived from orthographic aerial photos taken January 17, 2000.

DAY1/j:/hoover/Fig2_1TOPO.srf 05/23/00

FIGURE 2-1
Ground Surface Contours

Perimeter Investigation Report
The Hoover Company, North Canton, Ohio

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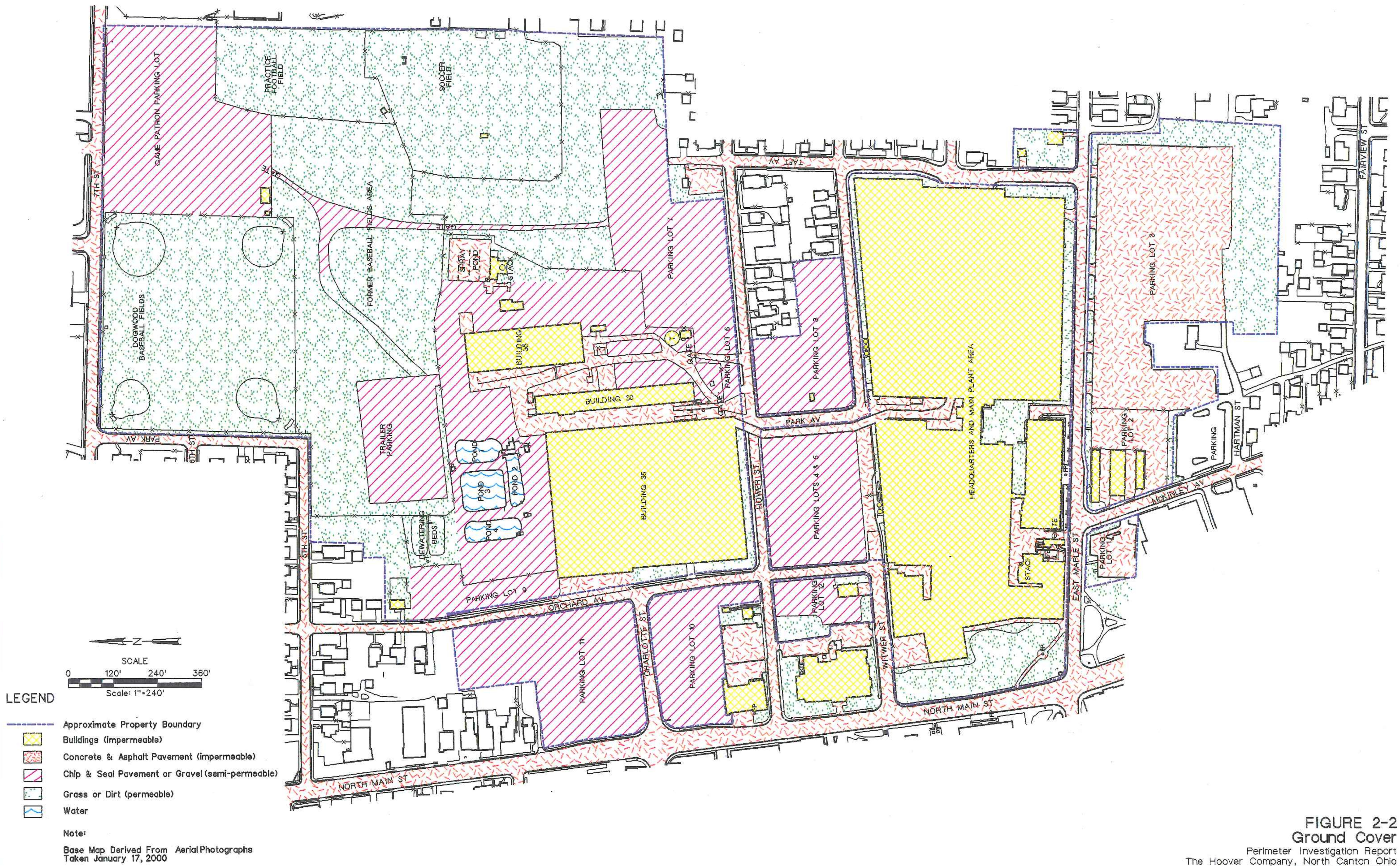
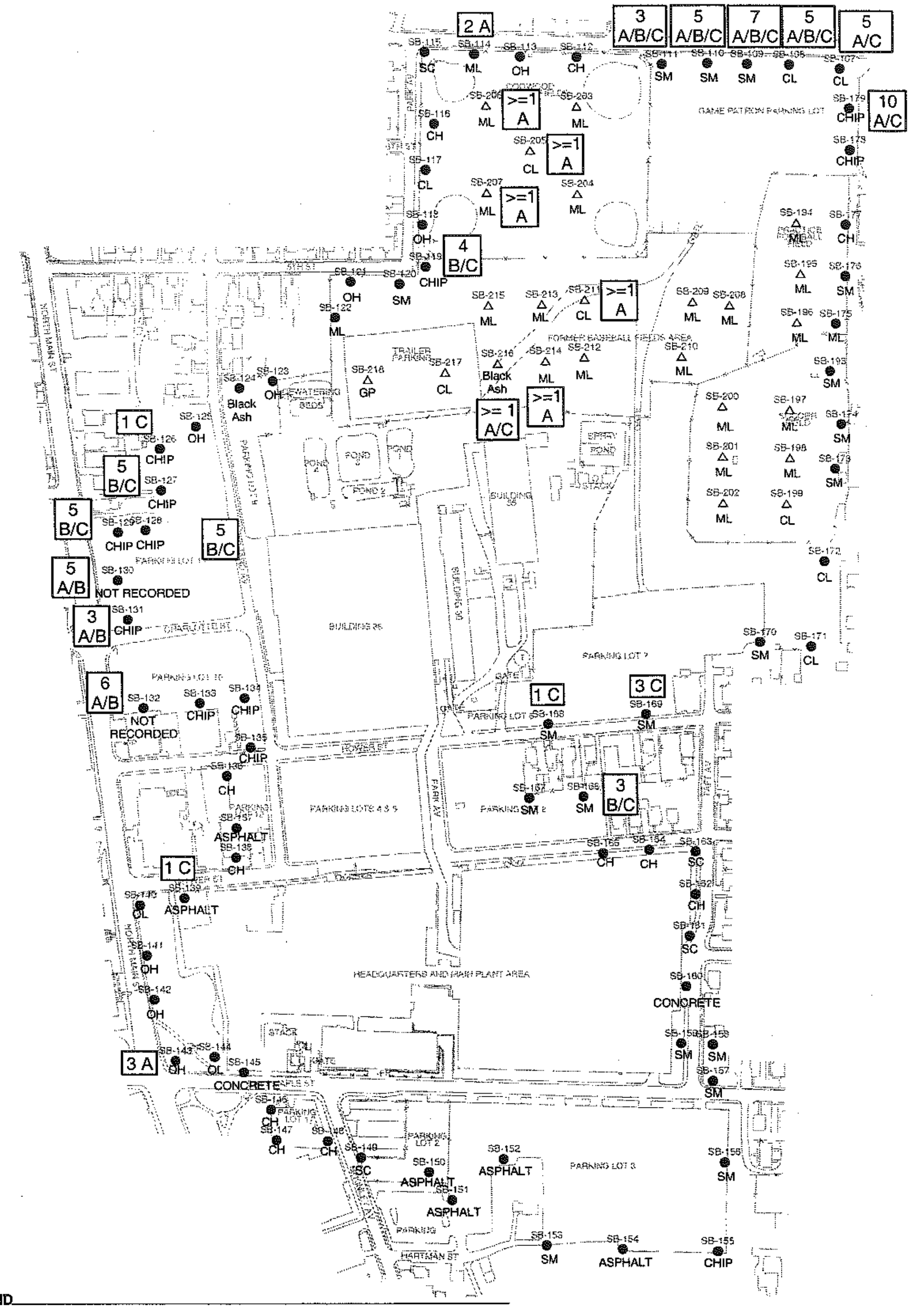


FIGURE 2-2
Ground Cover
Perimeter Investigation Report
The Hoover Company, North Canton Ohio
CH2MHILL

ANTIGONE:J:#HOOVER#8303COLR.DLV MRA 2000



LEGEND

- ● Perimeter investigation boring location (SB)
- △ Perimeter investigation shallow soil sampling location (SB)
- SM Ground cover type: soil (USCS) classification (SM = Sand w/silt, SC = Sand w/clay, CH = Fat clay, CL = Lean clay, ML = Lean silt, OH = high organic soil, OL = low organic soil) or other type term (Asphalt, Concrete, CHIP = Chip and Seal pavement, Black Ash)
- 3 C Fill material thickness (in feet) and type as noted in the boring logs: A = construction/soil fill (brick fragments, concrete); B = waste fill (plastic fragments, wire, black staining, ash); C = road base (asphalt, chip and seal)

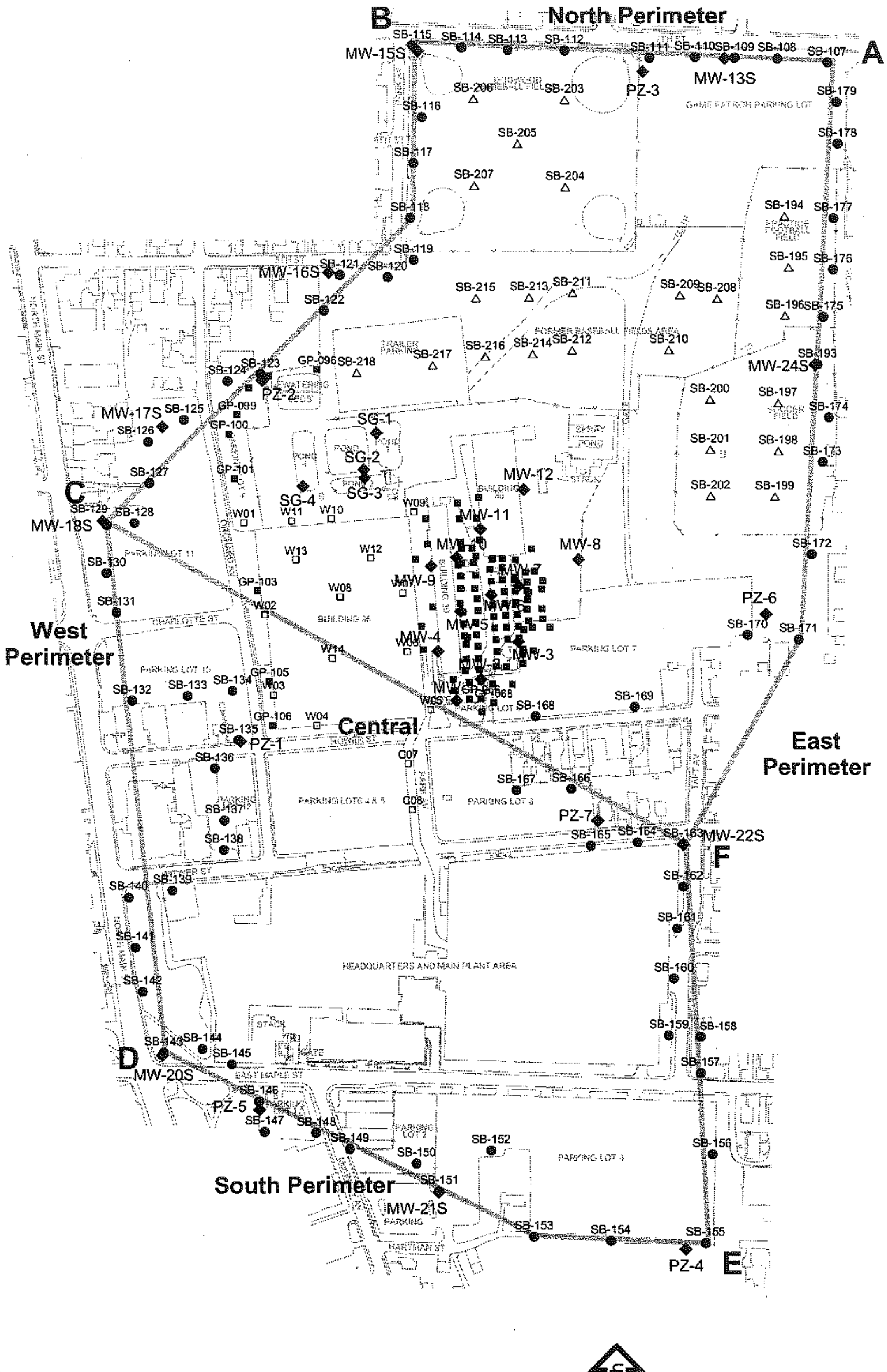
NOTES

1. Surficial fill thicknesses are rounded up to the nearest foot.
2. Base map derived from orthographic aerial photos taken January 17, 2000.

DAY1/j:/hoover/Fig2_3soilfill.srf (boring_gw.dat) 05/23/00

FIGURE 2-3
Ground Cover Type Distribution and Fill Thickness
Perimeter Investigation Report
The Hoover Company, North Canton, Ohio

CH2MHILL



LEGEND

- ◆ Facility piezometer (PZ), staff gauge or monitoring well (MW) location
- ● Perimeter investigation boring location (SB)
- △ Perimeter investigation shallow soil sampling location (SB)
- ■ Regulated unit investigation boring location (GP)
- □ Historical geotechnical boring location (W or C)
- D — E Approximate cross section location and labels

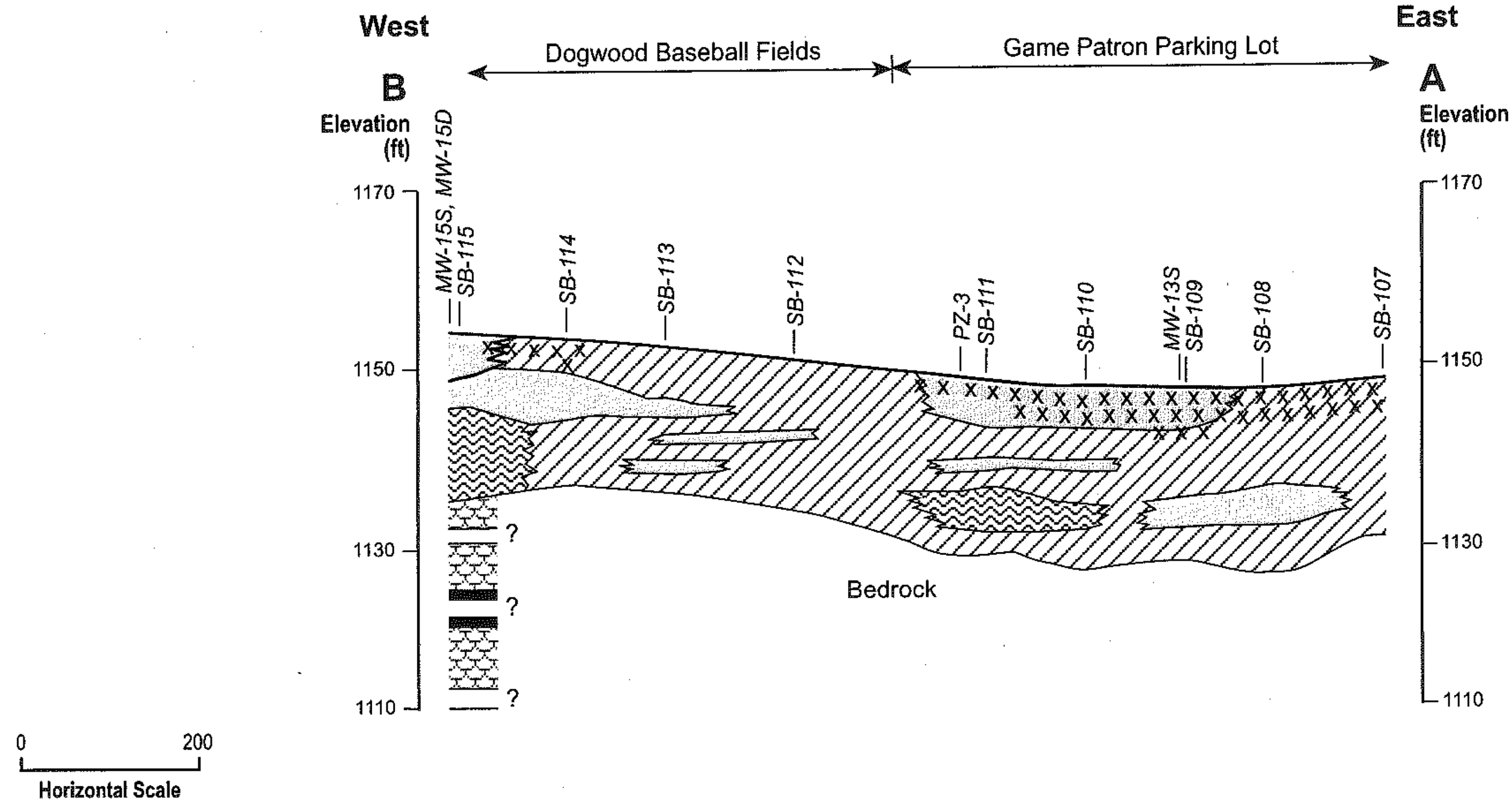
NOTES

1. Base map derived from orthographic aerial photos taken January 17, 2000.

FIGURE 2-4a
Cross Section Plan Map
Perimeter Investigation Report
The Hoover Company, North Canton, Ohio

CH2MHILL

DAY1/j:/hoover/Fig2_4aCXloc.srf (boring_gw2.dat and plant1gw2.dat) 05/04/00



LEGEND

x x x Fill

Coarse-Grained Deposits (sand, gravel, sand & gravel)

Coarse-Grained Deposits with Fines (sand with silt/clay, gravel with silt/clay, sand/gravel with silt/clay)

Fine-Grained Deposits (silt/clay, silt/clay with sand/gravel)

Bedrock Symbols

Shale

Coal

Sandstone

No Recovery

NOTES:

1. Elevations in feet above mean sea level are based on mean sea level data during 1980's (National Geodetic Vertical Datum of 1988).
2. The depth and thickness of the subsurface strata indicated on the section (profile) were generalized from and interpolated between test borings. Information on actual subsurface conditions exists only at the specific locations and dates indicated. Soil (rock) conditions and water levels at other locations may differ from conditions occuring at the boring locations. Also, the passage of time may result in a change in the conditions at these boring locations.

Figure 2-4b

Conceptual Geological Cross-Section BA (North Perimeter)

Perimeter Investigation Report

The Hoover Company, North Canton, Ohio

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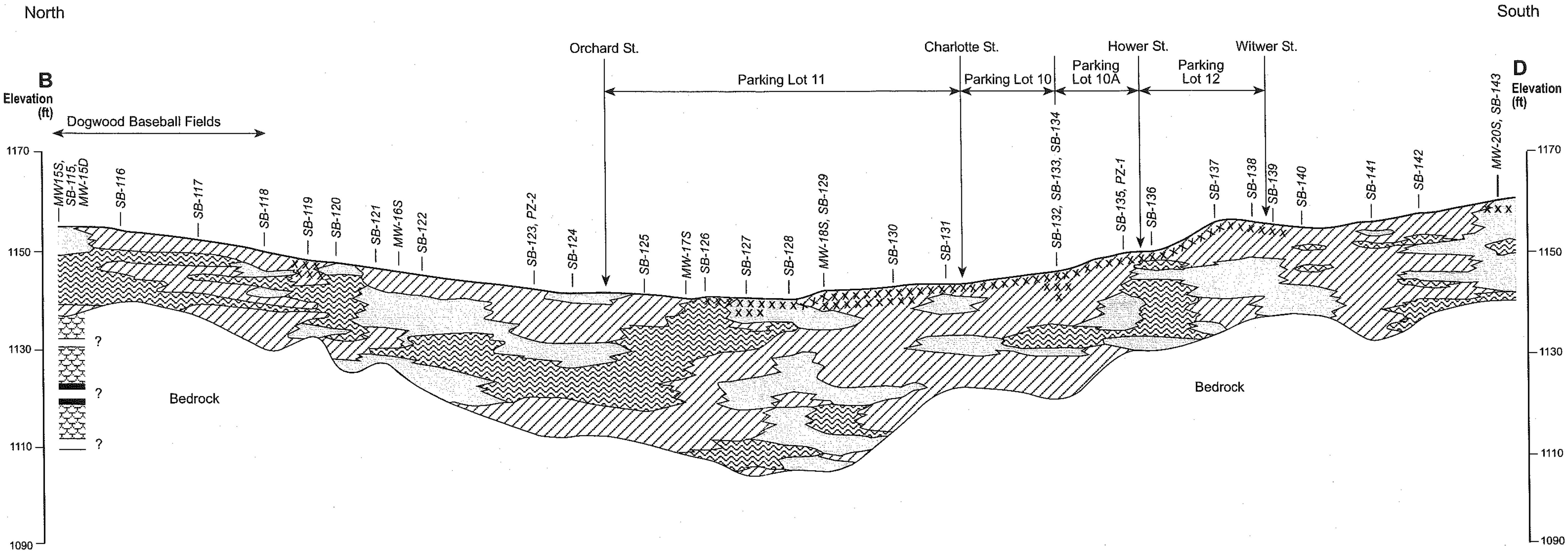

LEGEND

x x x Fill

Coarse-Grained Deposits (sand, gravel, sand & gravel)

Coarse-Grained Deposits with Fines (sand with silt/clay, gravel with silt/clay, sand/gravel with silt/clay)

Fine-Grained Deposits (silt/clay, silt/clay with sand/gravel)

Bedrock Symbols

Shale

Coal

Sandstone

No Recovery

NOTES:

1. Elevations in feet above mean sea level are based on mean sea level data during 1980's (National Geodetic Vertical Datum of 1988).
2. The depth and thickness of the subsurface strata indicated on the section (profile) were generalized from and interpolated between test borings. Information on actual subsurface conditions exists only at the specific locations and dates indicated. Soil (rock) conditions and water levels at other locations may differ from conditions occuring at the boring locations. Also, the passage of time may result in a change in the conditions at these boring locations.

0 200
Horizontal Scale

Figure 2-4c
Conceptual Geological Cross-Section BD (West Perimeter)
Perimeter Investigation Report
The Hoover Company, North Canton, Ohio

E155441.A2.ER.03 Section B-D Geologic 2-29-00 mjl

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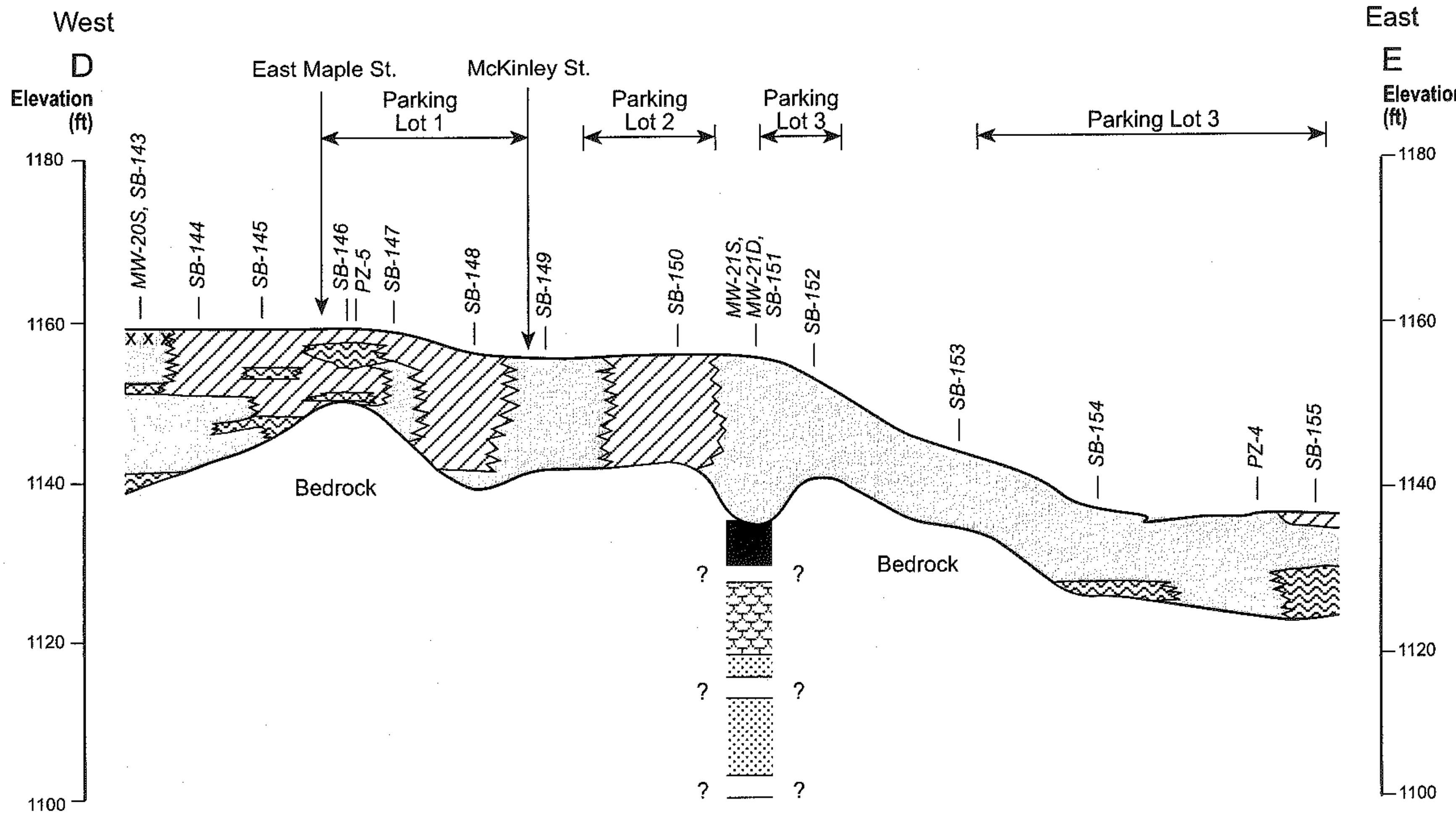


LEGEND

x x x Fill

Coarse-Grained Deposits (sand, gravel, sand & gravel)

Coarse-Grained Deposits with Fines (sand with silt/clay, gravel with silt/clay, sand/gravel with silt/clay)

Fine-Grained Deposits (silt/clay, silt/clay with sand/gravel)

Bedrock Symbols

Shale

Coal

Sandstone

No Recovery

0 200

Horizontal Scale

NOTES:

1. Elevations in feet above mean sea level are based on mean sea level data during 1980's (National Geodetic Vertical Datum of 1988).
2. The depth and thickness of the subsurface strata indicated on the section (profile) were generalized from and interpolated between test borings. Information on actual subsurface conditions exists only at the specific locations and dates indicated. Soil (rock) conditions and water levels at other locations may differ from conditions occuring at the boring locations. Also, the passage of time may result in a change in the conditions at these boring locations.

Figure 2-4d

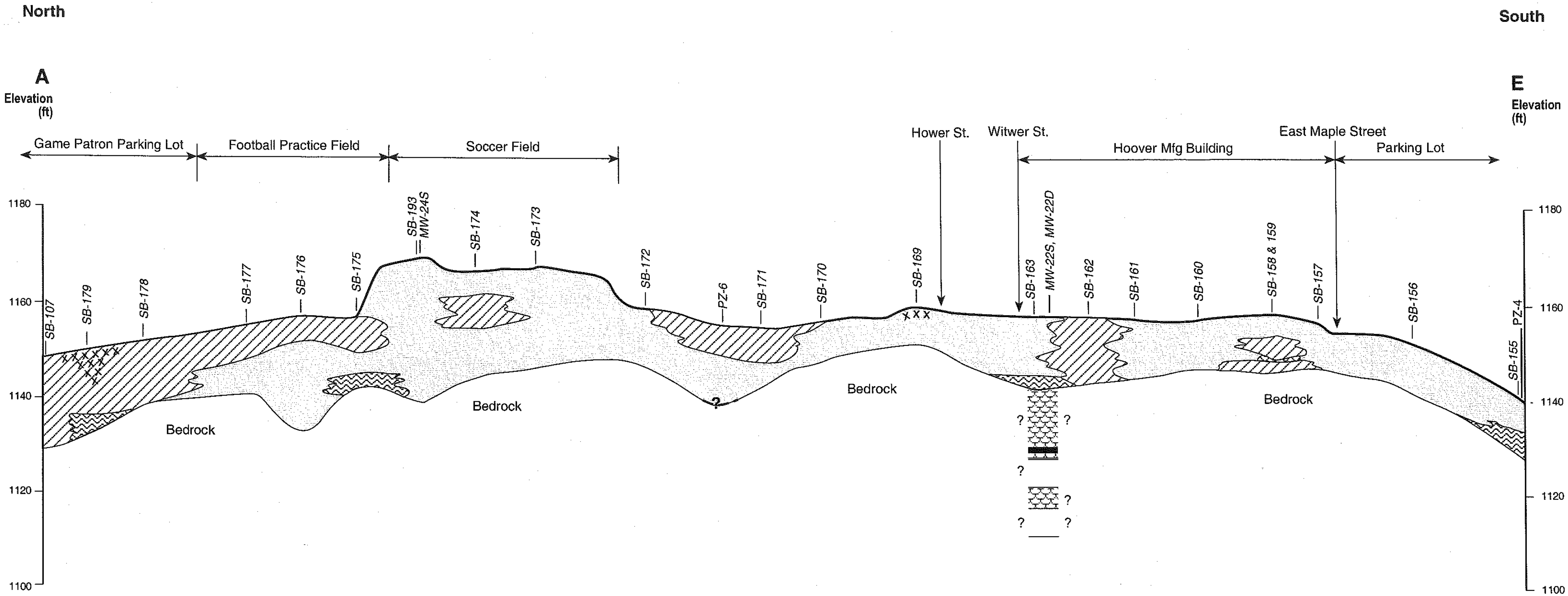
Conceptual Geological Cross-Section DE (South Perimeter)

Perimeter Investigation Report

The Hoover Company, North Canton, Ohio

CH2MHILL

E155441.A2.ER.03 Section D-E Geological 3-23-00 BI



LEGEND

XXX Fill

Coarse-Grained Deposits (sand, gravel, sand & gravel)

Coarse-Grained Deposits with Fines (sand with silt/clay, gravel with silt/clay, sand/gravel with silt/clay)

Fine-Grained Deposits (silt/clay, silt/clay with sand/gravel)

Bedrock Symbols

Shale

Coal

Sandstone

No Recovery

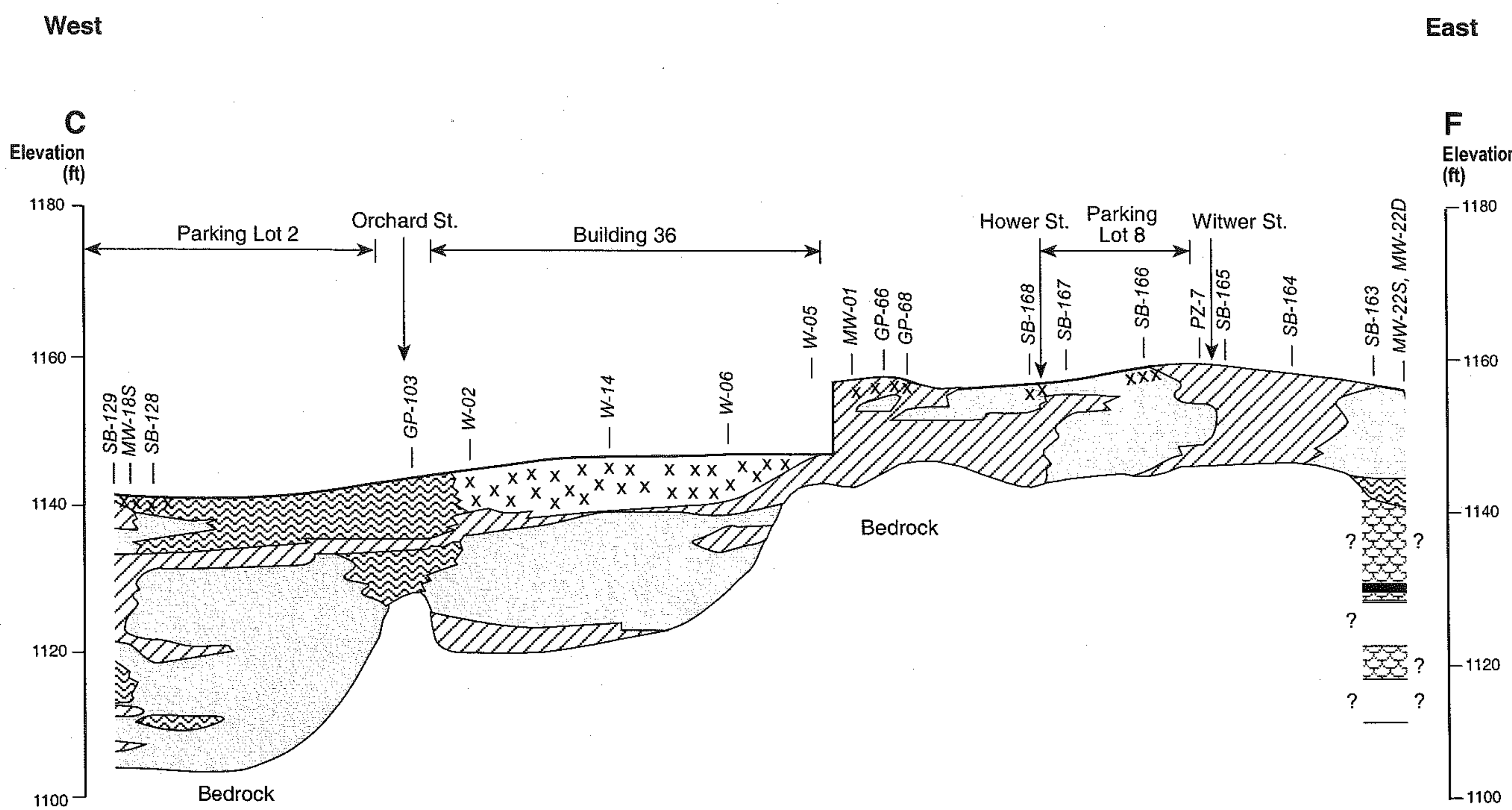
NOTES:

1. Elevations in feet above mean sea level are based on mean sea level data during 1980's (National Geodetic Vertical Datum of 1988).
2. The depth and thickness of the subsurface strata indicated on the section (profile) were generalized from and interpolated between test borings. Information on actual subsurface conditions exists only at the specific locations and dates indicated. Soil (rock) conditions and water levels at other locations may differ from conditions occuring at the boring locations. Also, the passage of time may result in a change in the conditions at these boring locations.

0 200
Horizontal Scale

Figure 2-4e
Conceptual Geological Cross-Section AE (East Perimeter)
Perimeter Investigation Report
The Hoover Company, North Canton, Ohio

CH2MHILL



LEGEND

x x x Fill

Coarse-Grained Deposits
(sand, gravel, sand & gravel)

Coarse-Grained Deposits with Fines
(sand with silt/clay, gravel with silt/clay, sand/gravel with silt/clay)

Fine-Grained Deposits
(silt/clay, silt/clay with sand/gravel)

Bedrock Symbols

Shale

Coal

Sandstone

No Recovery

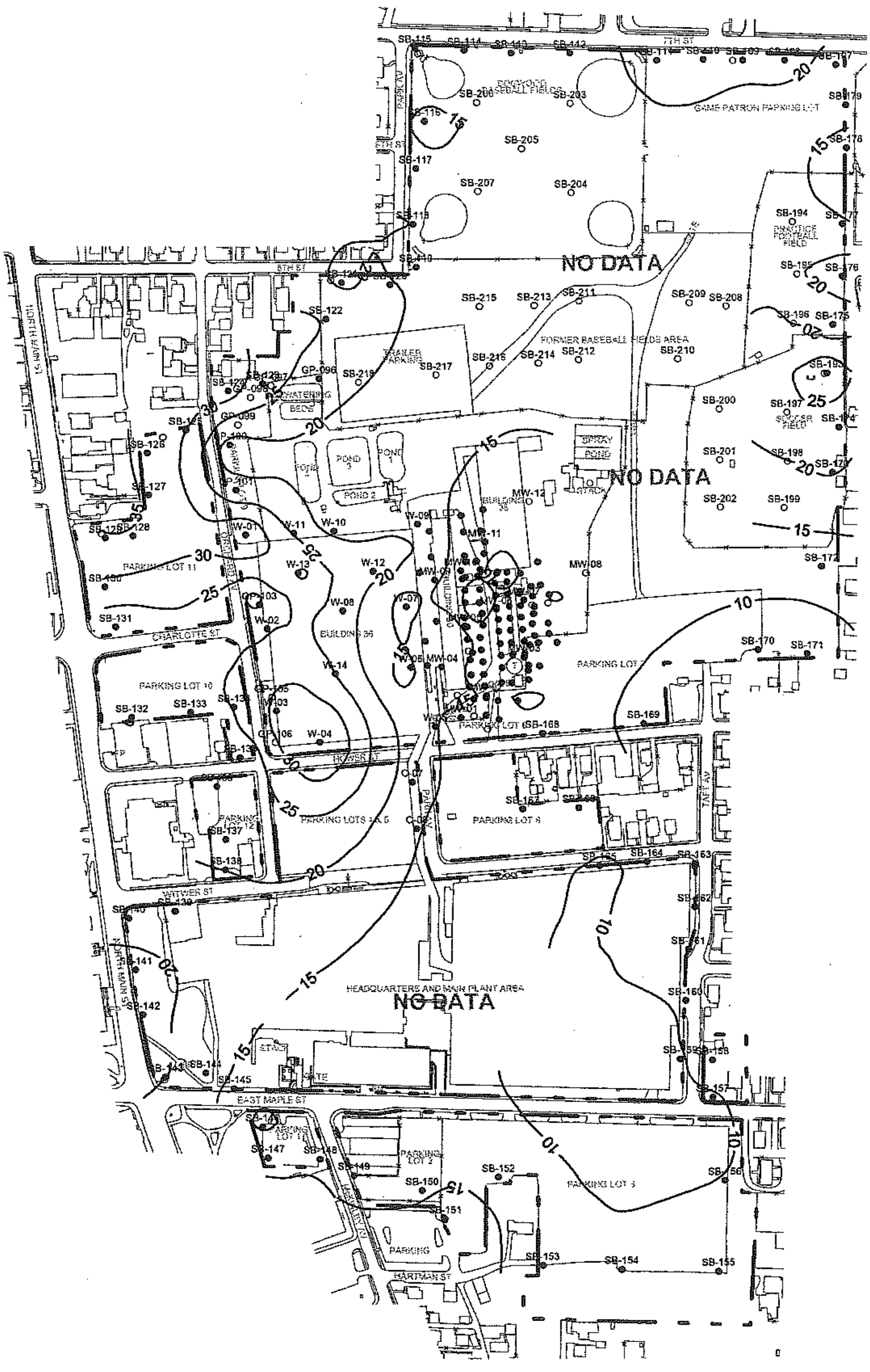
NOTES:
1. Elevations in feet above mean sea level are based on mean sea level data during 1980's (National Geodetic Vertical Datum of 1988).
2. The depth and thickness of the subsurface strata indicated on the section (profile) were generalized from and interpolated between test borings. Information on actual subsurface conditions exists only at the specific locations and dates indicated. Soil (rock) conditions and water levels at other locations may differ from conditions occuring at the boring locations. Also, the passage of time may result in a change in the conditions at these boring locations.

0 200
Horizontal Scale

Figure 2-4f
Conceptual Geological Cross-Section CF (Central)
Perimeter Investigation Report
The Hoover Company, North Canton, Ohio

CH2MHILL

E155441.A2.ER.03 Section C-F Geological 3-23-00 mjh



LEGEND

—20—	Unconsolidated material thickness contour (contour interval = 5 feet). Labels are oriented upgradient.
●	Soil boring location with thickness data
○	Soil boring location without thickness data
— —	Approximate Hoover property boundary

NOTES

1. Base map derived from orthographic aerial photos taken January 17, 2000.

North

0 100 200 300 400
Feet

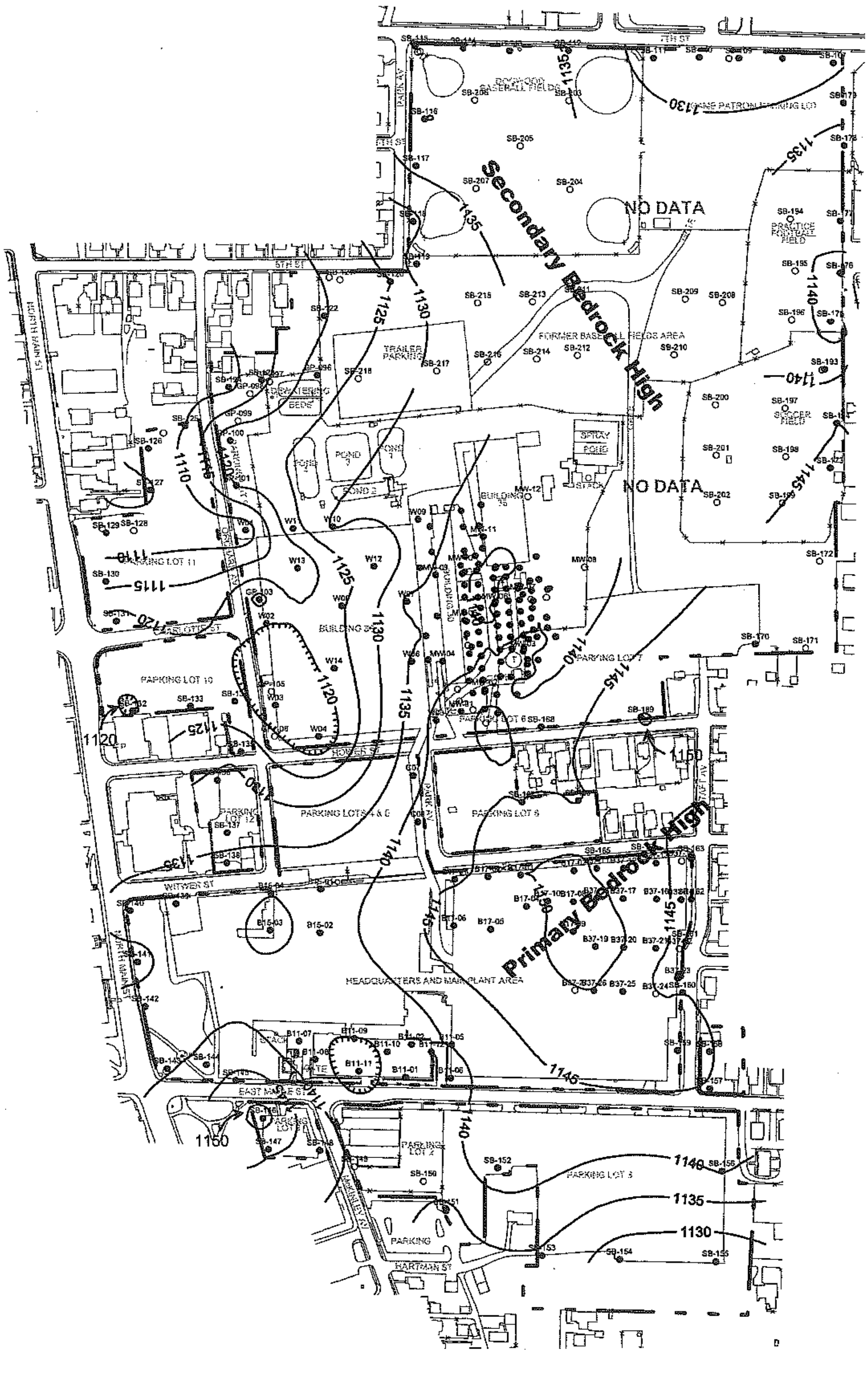
FIGURE 2-5

Estimated Thickness of the Unconsolidated Material

Perimeter Investigation Report
The Hoover Company, North Canton, Ohio

CH2MHILL

J:/Hoover/SurfFigs/Fig2_5Gla.SRF (plant1gl.dat) 05/04/00



LEGEND

— 1140 —	Bedrock elevation contour (contour interval = 5 feet). Labels are oriented upgradient. Inward hatches indicate depressions.
●	Soil boring location with bedrock data
○	Soil boring location without bedrock data
— —	Approximate Hoover property boundary

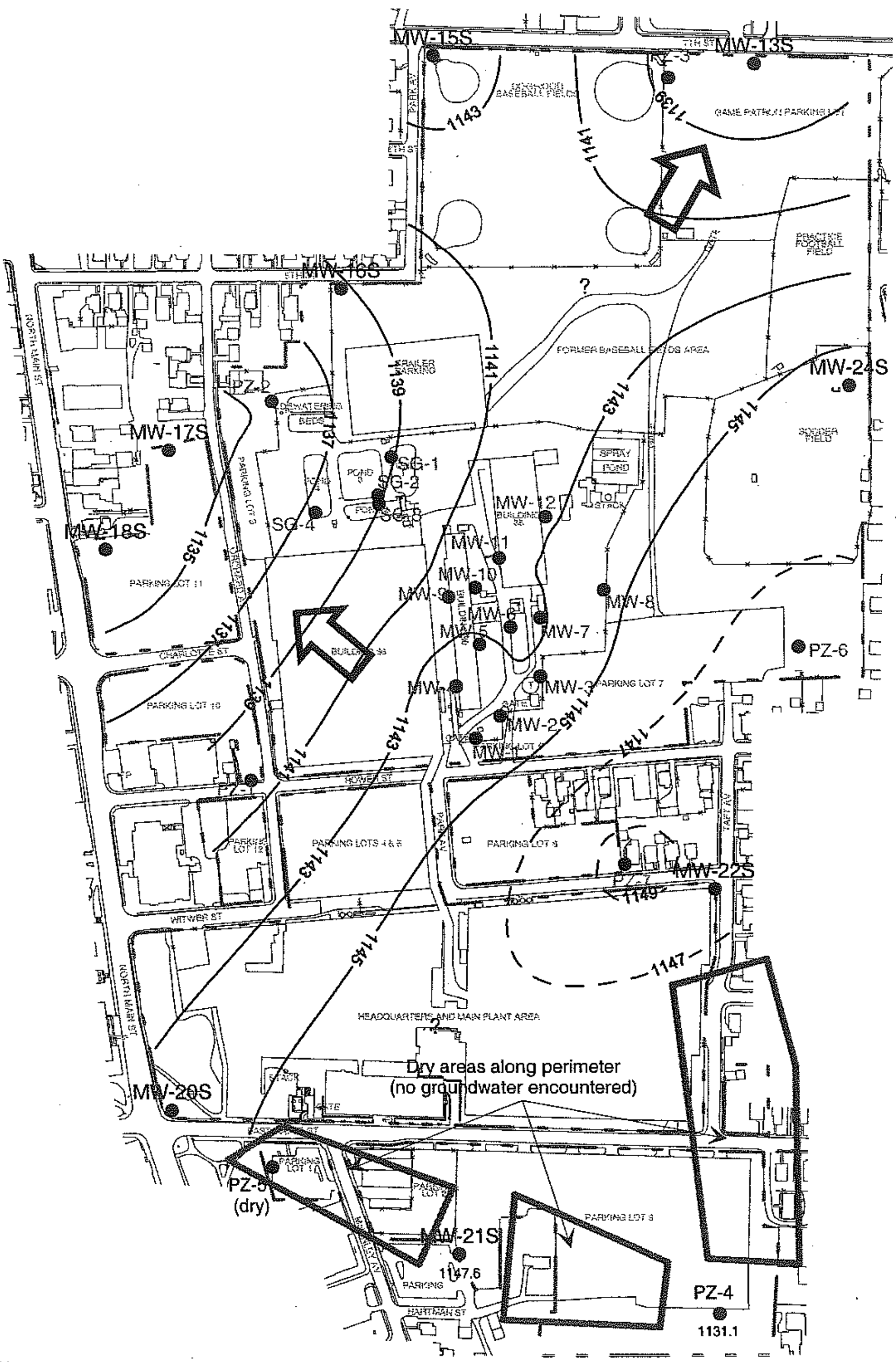
North

0 100 200 300 400
Scale: 1 inch = 400 feet

NOTES
1. Elevations reference National Geodetic Vertical Datum of 1988 (NGVD88).
2. Base map derived from orthographic aerial photos taken January 17, 2000.

J:/Hoover/SurfFigs/Fig2_6PerimBrk.SRF (plant1bk.dat) 05/04/00

FIGURE 2-6
Estimated Bedrock Surface Elevation
Perimeter Investigation Report
The Hoover Company, North Canton, Ohio
CH2MHILL



LEGEND

MW-18S ●	Facility Piezometer (PZ), Staff Gauge (SG), and Monitoring Well (MW) identifier and location
1142	Groundwater surface elevation (feet) and contour
— — -	Inferred groundwater contour (shown only to illustrate the effect of the bedrock high on the groundwater elevations)
⇖	Groundwater gradient direction
?	Groundwater surface elevation unknown
— — -	Approximate property boundary

North

0 100 200 300 400
FEET

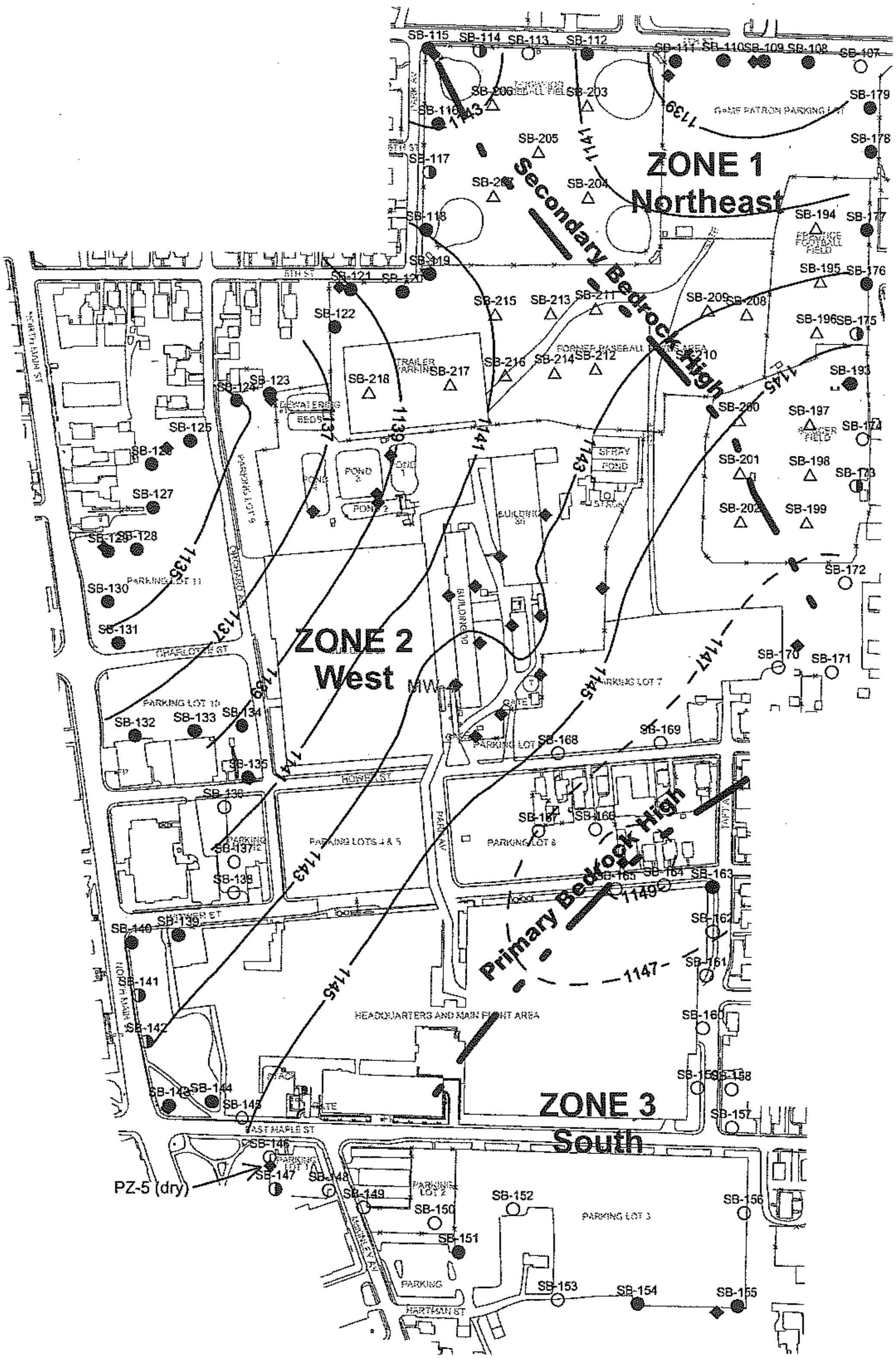
NOTES

1. All monitoring wells and piezometers, but none of the staff gauges, were used in interpreting the groundwater surface. Groundwater contours assume the ponds north of Building 36 do not significantly impact groundwater levels or flow direction.
2. Elevations reference National Geodetic Vertical Datum of 1988 (NGVD88).
3. Base map derived from orthographic aerial photos taken January 17, 2000.

DAY1/j:/hoover/Fig2_7GW0100.srf (fgwelev.dat) 05/23/00

FIGURE 2-7
Groundwater Surface Contours and Gradients
Perimeter Investigation Report
The Hoover Company, North Canton, Ohio

CH2MHILL



LEGEND

- ◆ Facility piezometer, staff gauge, or monitoring well location
- ● Sampling location with full analytical suite collected
- ◑ Sampling location with partial analytical suite collected
- ○ Dry sampling location
- △ Shallow soil sampling location
- 1142 Groundwater surface elevation (feet) and contour
- Inferred groundwater surface elevation contour
- No-flow divide and boundary between groundwater zones

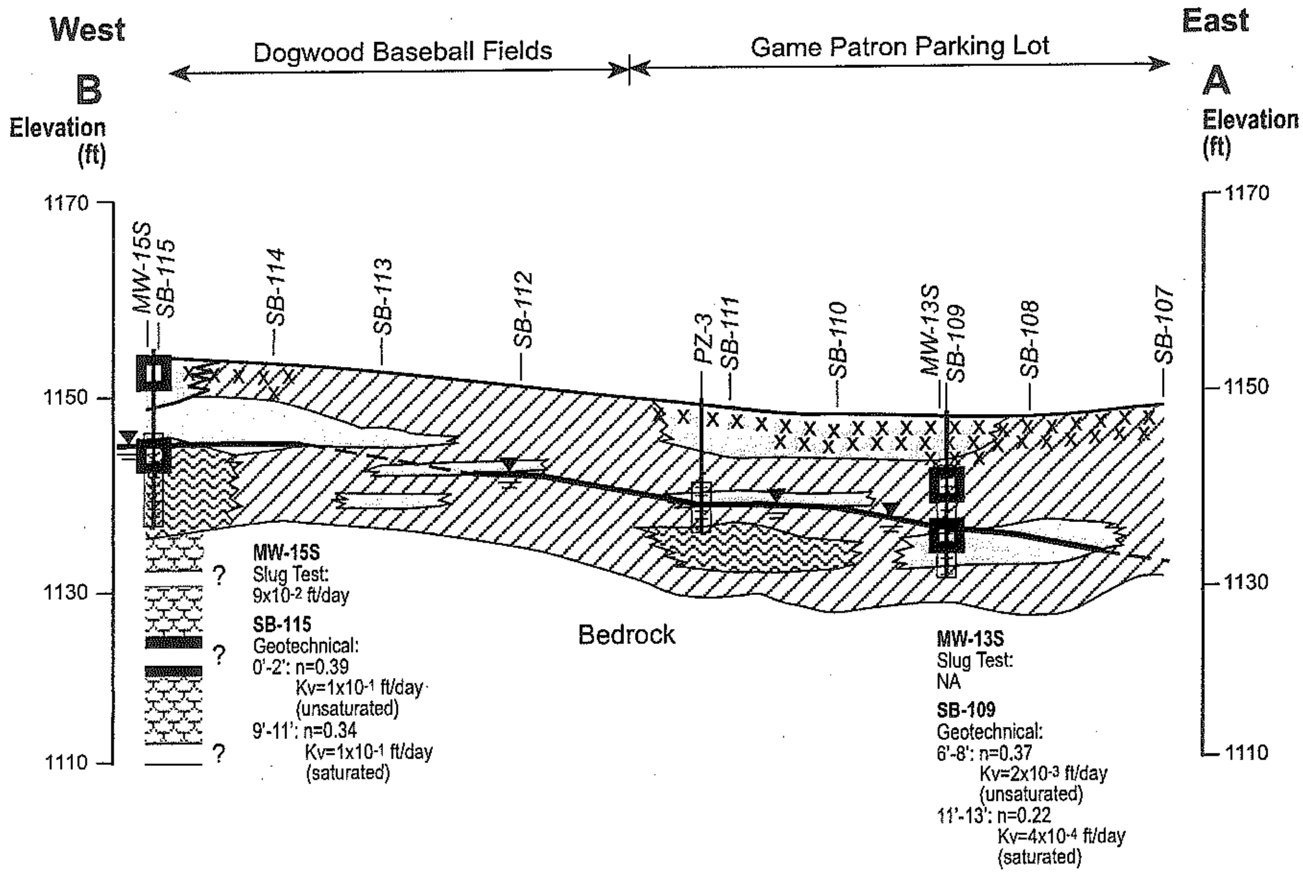
NOTES

1. All monitoring wells and piezometers, but none of the staff gauges, were used in interpreting the groundwater surface. Groundwater contours assume the ponds north of Building 36 do not significantly impact groundwater levels or flow direction.
2. Elevations reference National Geodetic Vertical Datum of 1988 (NGVD88).
3. Base map derived from orthographic aerial photos taken January 17, 2000.

DAY1/j:/hoover/Fig2_8GWZones.srf (boring_gw.dat) 05/04/00

FIGURE 2-8
Groundwater Zones and Supporting Data
Perimeter Investigation Report
The Hoover Company, North Canton, Ohio

CH2MHILL



LEGEND

- x x x Fill
- Coarse-Grained Deposits (sand, gravel, sand & gravel)
- Coarse-Grained Deposits with Fines (sand with silt/clay, gravel with silt/clay, sand/gravel with silt/clay)
- Fine-Grained Deposits (silt/clay, silt/clay with sand/gravel)
- Water Table
- Inferred Water Table (Locations Dry)
- Monitoring Well or Piezometer Screened Interval
- Geotechnical Sample Interval

Bedrock Symbols

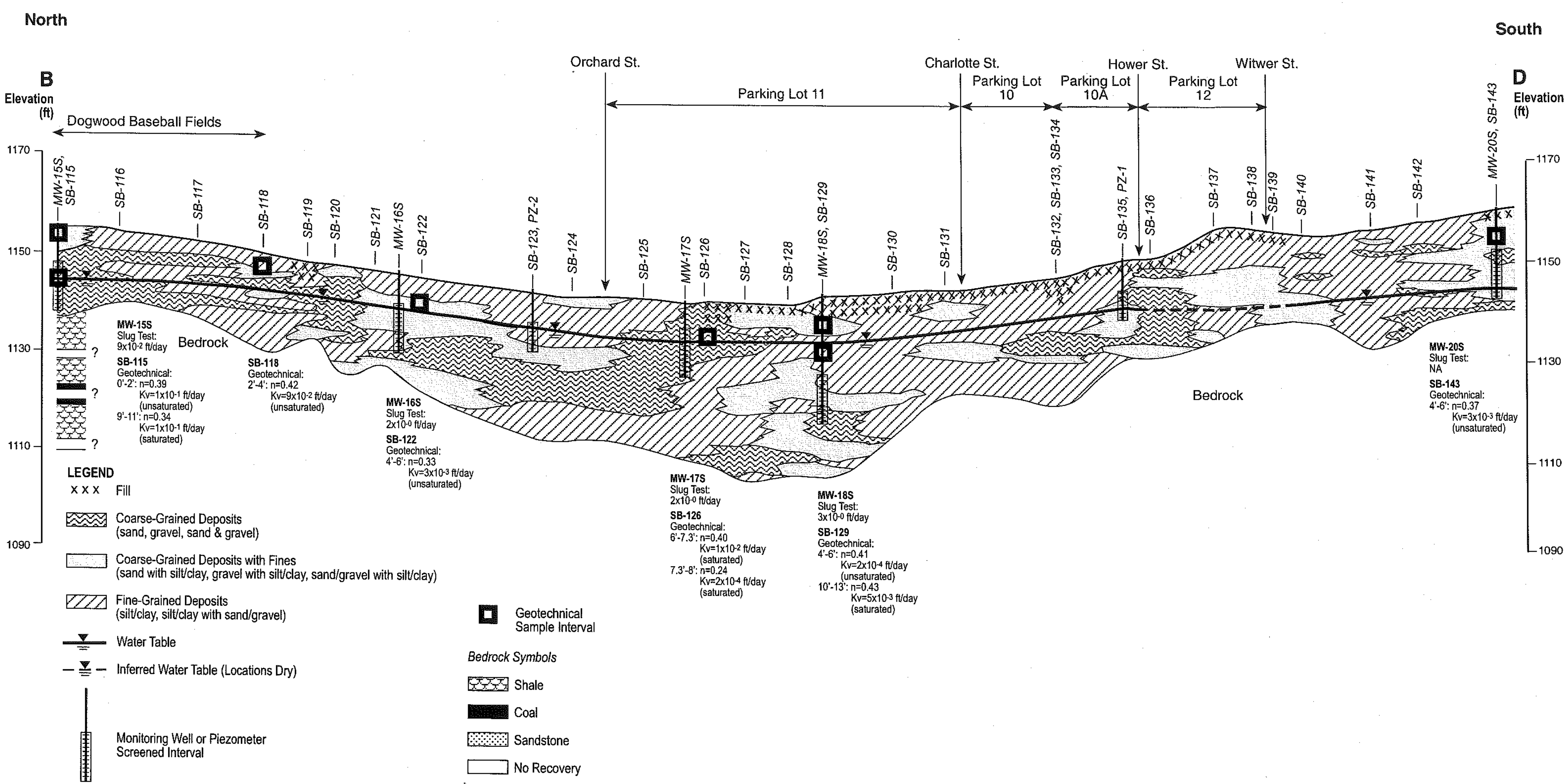
- Shale
- Coal
- Sandstone
- No Recovery

0 200
Horizontal Scale

NOTES:
1. Elevations in feet above mean sea level are based on mean sea level data during 1980's (National Geodetic Vertical Datum of 1988).
2. The depth and thickness of the subsurface strata indicated on the section (profile) were generalized from and interpolated between test borings. Information on actual subsurface conditions exists only at the specific locations and dates indicated. Soil (rock) conditions and water levels at other locations may differ from conditions occuring at the boring locations. Also, the passage of time may result in a change in the conditions at these boring locations.

Figure 2-9a
Conceptual Hydrogeological Cross-Section BA (North Perimeter)
Perimeter Investigation Report
The Hoover Company, North Canton, Ohio
CH2MHILL

E155141.A2.ER.03 Section A-B Hydrogeological 3-23-00 mjl



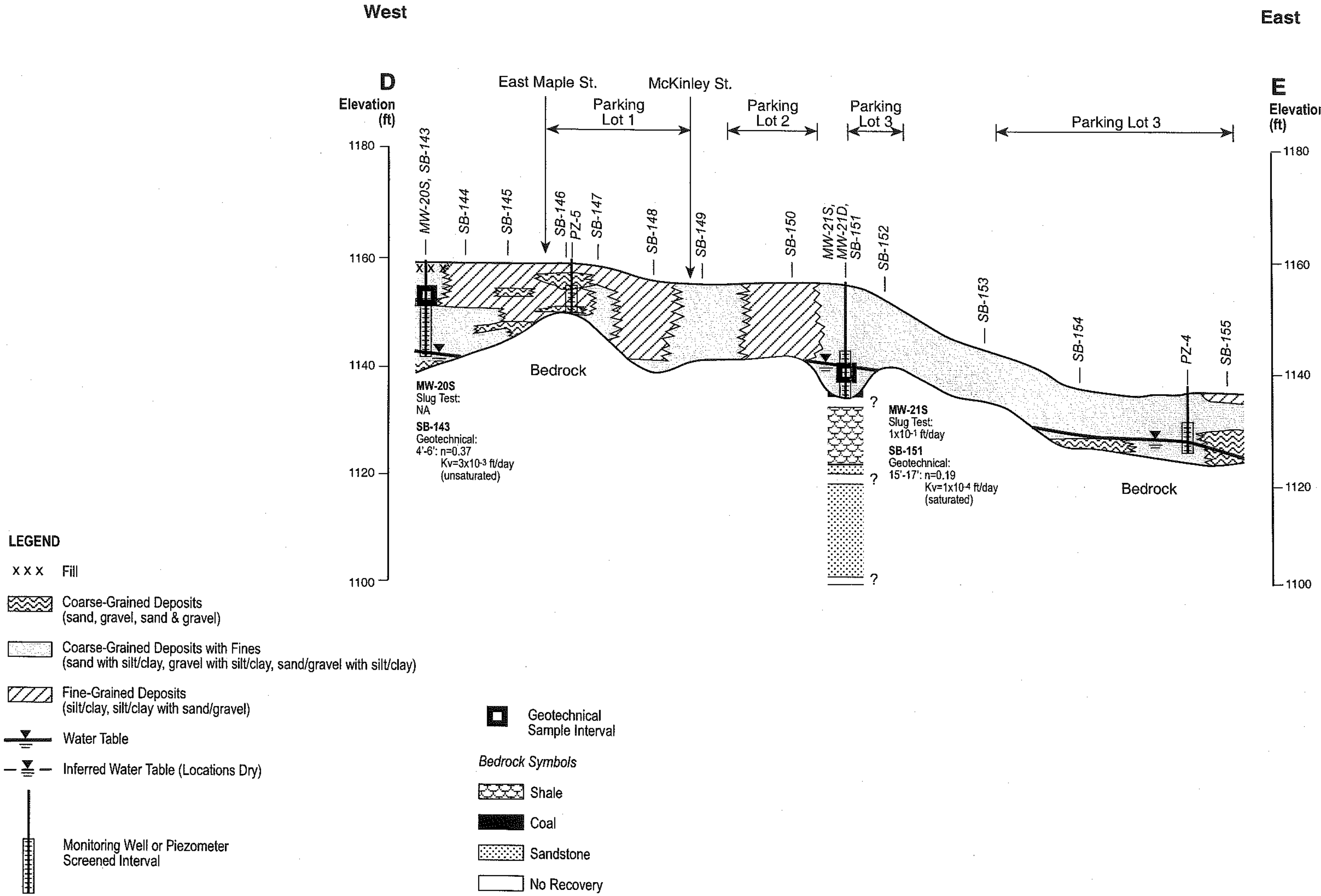
NOTES:
1. Elevations in feet above mean sea level are based on mean sea level data during 1980's (National Geodetic Vertical Datum of 1988).
2. The depth and thickness of the subsurface strata indicated on the section (profile) were generalized from and interpolated between test borings. Information on actual subsurface conditions exists only at the specific locations and dates indicated. Soil (rock) conditions and water levels at other locations may differ from conditions occuring at the boring locations. Also, the passage of time may result in a change in the conditions at these boring locations.

0 200
Horizontal Scale

Figure 2-9b
Conceptual Hydrogeological Cross-Section BD (West Perimeter)
Perimeter Investigation Report
The Hoover Company, North Canton, Ohio

E155441.A2.ER.03 Section B-D Hydrogeological 3-22-00 mf

CH2MHILL

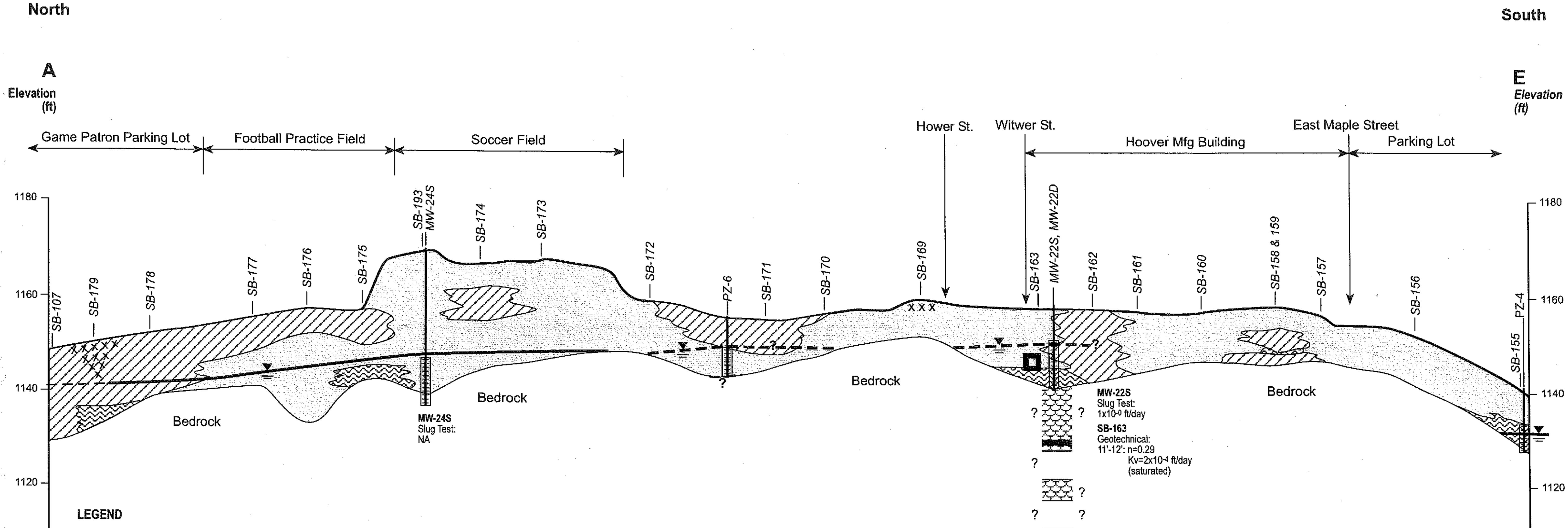


NOTES:

1. Elevations in feet above mean sea level are based on mean sea level data during 1980's (National Geodetic Vertical Datum of 1988).
2. The depth and thickness of the subsurface strata indicated on the section (profile) were generalized from and interpolated between test borings. Information on actual subsurface conditions exists only at the specific locations and dates indicated. Soil (rock) conditions and water levels at other locations may differ from conditions occuring at the boring locations. Also, the passage of time may result in a change in the conditions at these boring locations.

0 200
Horizontal Scale

Figure 2-9c
Conceptual Hydrogeological Cross-Section DE (South Perimeter)
Perimeter Investigation Report
The Hoover Company, North Canton, Ohio



LEGEND

- x x x Fill
- Coarse-Grained Deposits (sand, gravel, sand & gravel)
- Coarse-Grained Deposits with Fines (sand with silt/clay, gravel with silt/clay, sand/gravel with silt/clay)
- Fine-Grained Deposits (silt/clay, silt/clay with sand/gravel)
- Water Table
- Inferred Water Table (Locations Dry)
- Monitoring Well or Piezometer Screened Interval
- Geotechnical Sample Interval

Bedrock Symbols

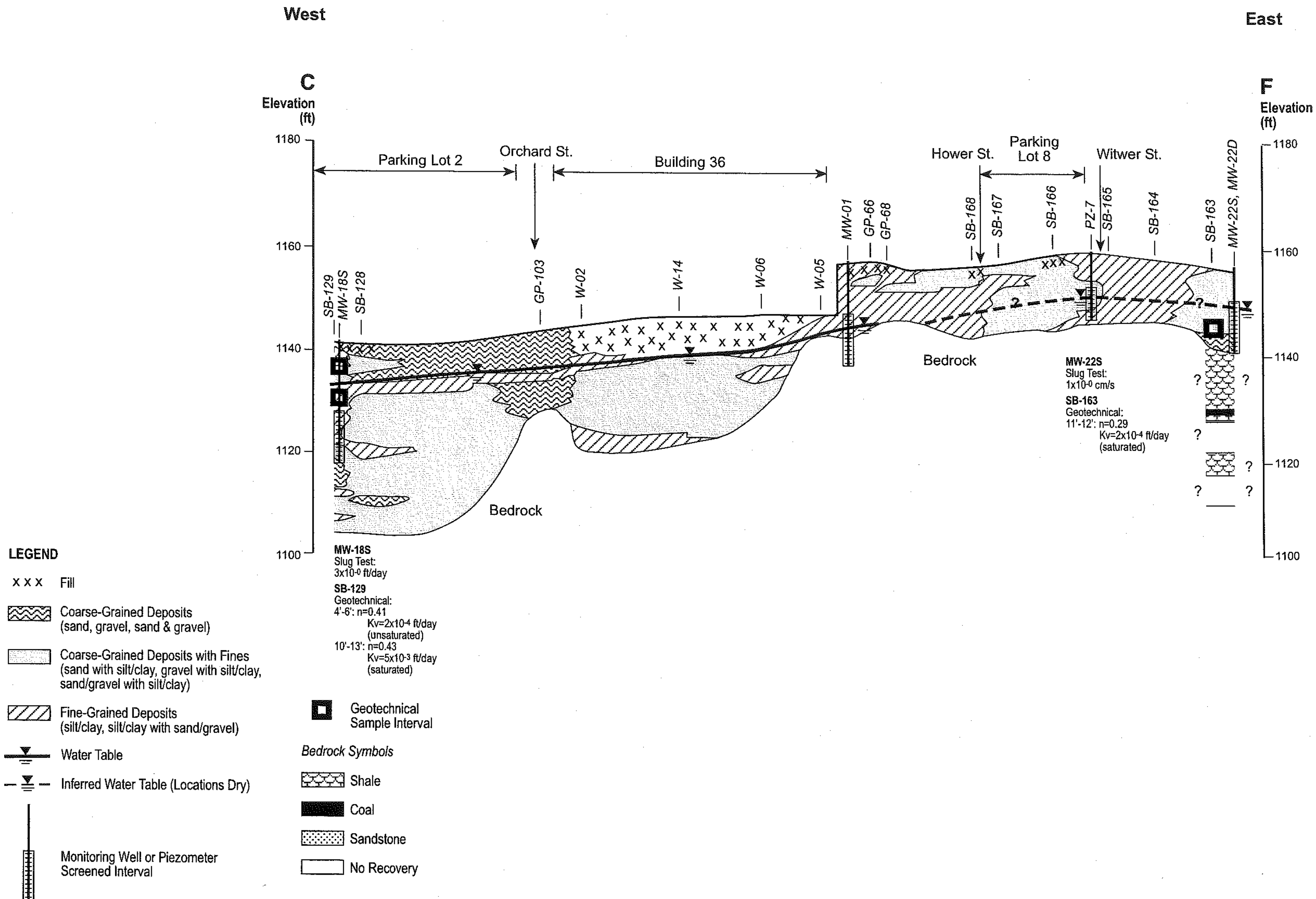
- Shale
- Coal
- Sandstone
- No Recovery

0 200
Horizontal Scale

NOTES:
1. Elevations in feet above mean sea level are based on mean sea level data during 1980's (National Geodetic Vertical Datum of 1988).
2. The depth and thickness of the subsurface strata indicated on the section (profile) were generalized from and interpolated between test borings. Information on actual subsurface conditions exists only at the specific locations and dates indicated. Soil (rock) conditions and water levels at other locations may differ from conditions occuring at the boring locations. Also, the passage of time may result in a change in the conditions at these boring locations.

Figure 2-9d
Conceptual Hydrogeological Cross-Section AE (East Perimeter)
Perimeter Investigation Report
The Hoover Company, North Canton, Ohio

CH2MHILL



NOTES:

1. Elevations in feet above mean sea level are based on mean sea level data during 1980's (National Geodetic Vertical Datum of 1988).
2. The depth and thickness of the subsurface strata indicated on the section (profile) were generalized from and interpolated between test borings. Information on actual subsurface conditions exists only at the specific locations and dates indicated. Soil (rock) conditions and water levels at other locations may differ from conditions occuring at the boring locations. Also, the passage of time may result in a change in the conditions at these boring locations.

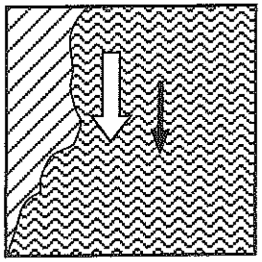
Figure 2-9e

Conceptual Hydrogeological Cross-Section CF (Central)

Perimeter Investigation Report
The Hoover Company, North Canton, Ohio

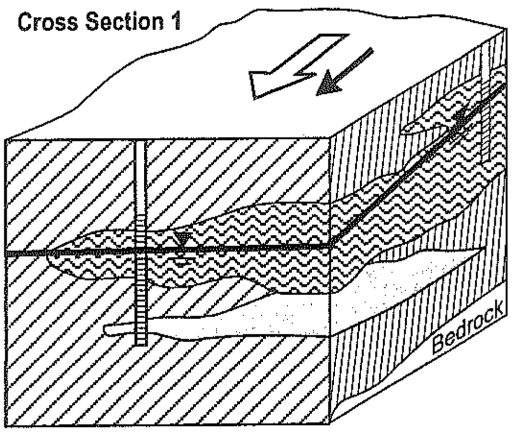
SCENARIO 1

Plan View 1



Groundwater gradient and actual groundwater flow direction are the same.

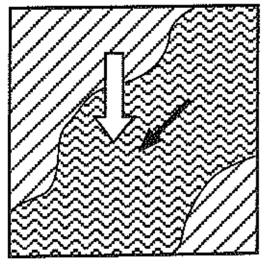
Cross Section 1



Coarse and coarse with fine are in alignment with gradient.

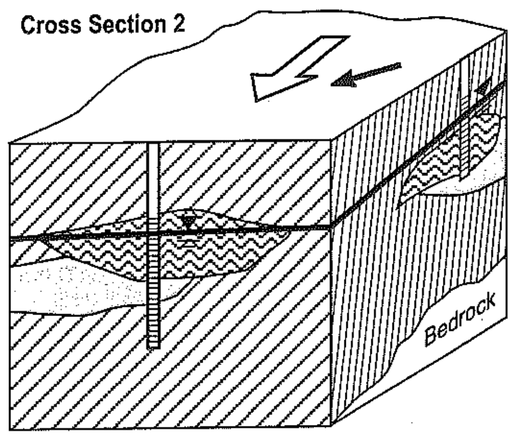
SCENARIO 2

Plan View 2



Groundwater gradient and actual groundwater flow direction are at an angle due to local geology.

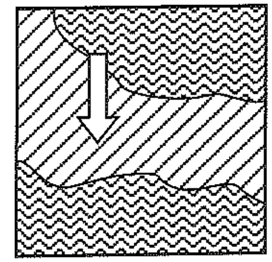
Cross Section 2



Coarse and coarse with fine deposits are at an angle to gradient.

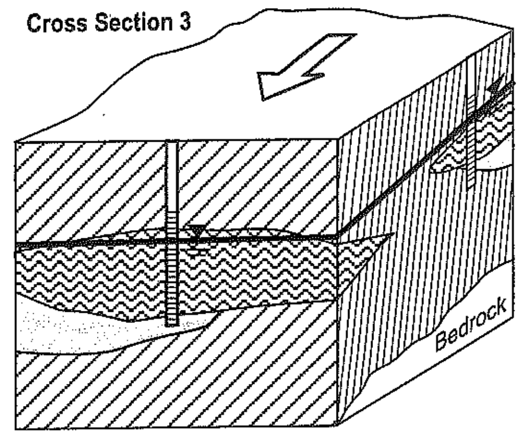
SCENARIO 3

Plan View 3



Groundwater-producing deposits are not connected so there is near-zero groundwater flow. The gradient does not reflect actual flow conditions.

Cross Section 3



Coarse and coarse with fine deposits are not aligned with gradient.

LEGEND

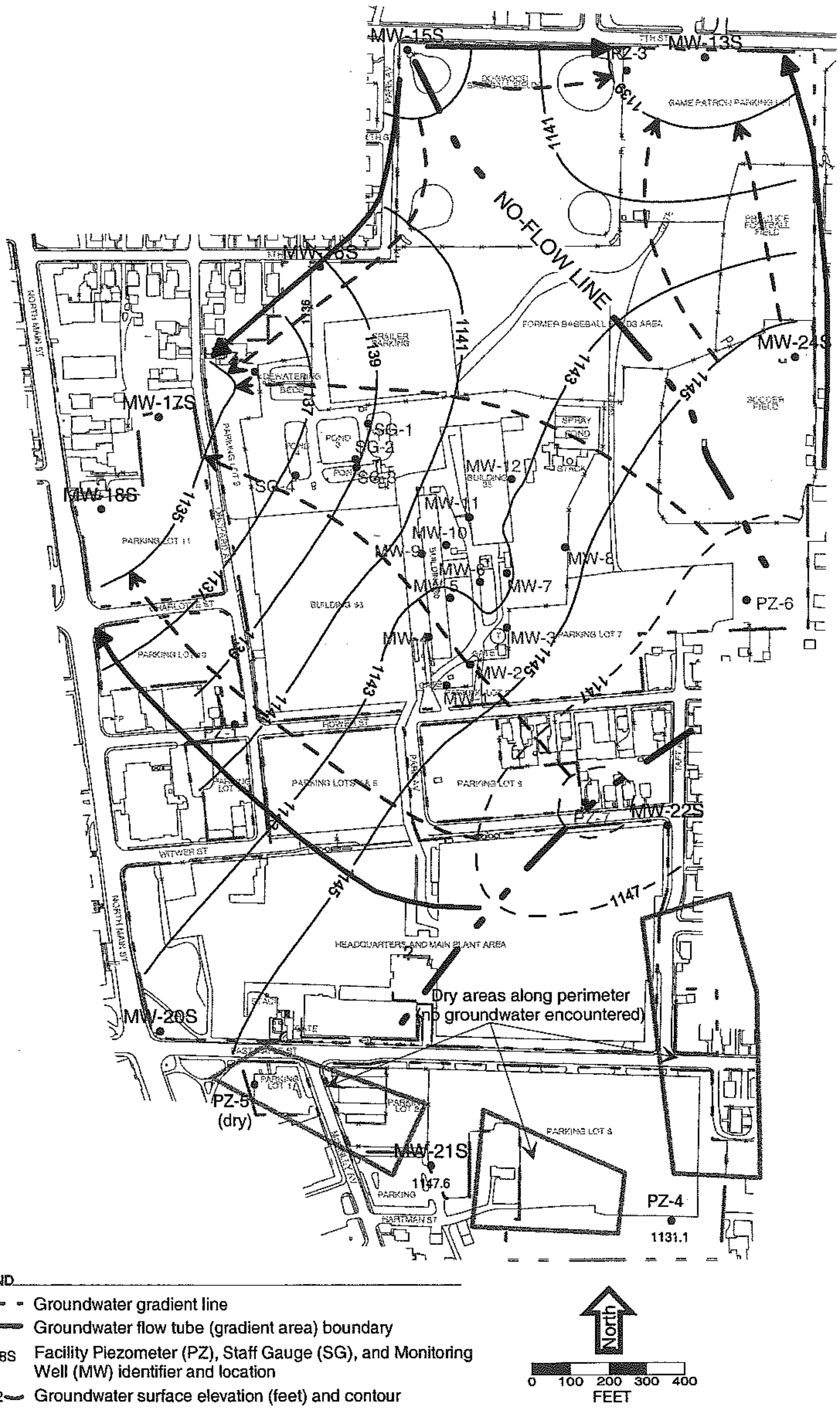
- Overall Direction of Groundwater Gradient
- Groundwater Elevation
- Groundwater Monitoring Well
- Potential Local Direction of Groundwater Flow
- Coarse-Grained Deposits (sand, gravel, sand & gravel)
- Coarse-Grained Deposits with Fines (sand with silt/clay, gravel with silt/clay, sand/gravel with silt/clay)
- Fine-Grained Deposits (silt/clay, silt/clay with sand/gravel)

Figure 2-10

Groundwater Flow Conceptual Model for Zones 1 and 2

Perimeter Investigation Report
The Hoover Company, North Canton, Ohio

CH2MHILL



LEGEND

- Groundwater gradient line
- Groundwater flow tube (gradient area) boundary
- MW-18S • Facility Piezometer (PZ), Staff Gauge (SG), and Monitoring Well (MW) identifier and location
- 1142 Groundwater surface elevation (feet) and contour
- Inferred groundwater surface elevation contour

NOTES

1. All monitoring wells and piezometers, but none of the staff gauges, were used in interpreting the groundwater surface. Groundwater contours assume the ponds north of Building 36 do not significantly impact groundwater levels or flow direction.
2. Elevations reference National Geodetic Vertical Datum of 1988 (NGVD88).
3. Base map derived from orthographic aerial photos taken January 17, 2000.

DAY1/j:/hoover/Fig2_11GWtubes.srf (lgwelev.dat) 05/23/00

FIGURE 2-11
Generalized Groundwater Flow by Zone

Perimeter Investigation Report
The Hoover Company, North Canton, Ohio

CH2MHILL

SECTION 3

Environmental Quality

This section summarizes information regarding the kinds and the locations of chemical compounds detected in soil and groundwater during the Perimeter Investigation. As part of future evaluations, this information will be considered with respect to historic information regarding facility operations and land use, regional background information on naturally-occurring compounds (i.e. metals), and information from previous site investigations at the Regulated Unit (the former drum storage area) to develop a more comprehensive picture of site conditions. This integrated picture will be presented in a separate document, and not as part of this Perimeter Investigation Report.

As previously noted (Section 1), samples collected from each of the 99 boring locations were analyzed for the 60 compounds on the Perimeter Investigation Target Analyte List. Samples from 25 of those 99 locations were also analyzed for an expanded set of the 228 chemicals found on USEPA's Appendix IX list. The Perimeter Investigation Target Analyte List can be divided into three main groups of chemicals: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. The Appendix IX list includes additional compounds in each of these groups, as well as other organic chemicals (pesticides, PCB, dioxins) which were not suspected to be present at the site based on historical process and chemical use information.

Supplemental analysis also were performed at approximately 10 percent of the locations to obtain information that can be used to assess and develop potential remedial actions, if it is determined that a remedy is necessary to protect human health and the environment. These sampling locations were analyzed for general chemistry, treatability, or geotechnical parameters.

For the purposes of this report, the term "analytical records" refers to the analytical results received from the lab. An analytical record will typically indicate whether a result was below a detection limit with a descriptor such as "ND" (nondetect) or will report a concentration for a result that exceeded the detection limit. Detection limits are set by the physical limitations of the analytical process and equipment, and are essentially the minimum concentrations that can be "seen" by the analytical laboratory.

Results received from the lab were reviewed for completeness and then the Quality Assurance/Quality Control (QA/QC) process was conducted to evaluate data quality. This QA/QC process is described in the *RCRA Facility Investigation, Program Quality Assurance Project Plan* (CH2M Hill 1999c).

Once data quality was evaluated, data were then loaded into a data base and the data were compared to Target Levels. The Target Levels were developed in accordance with the Voluntary Corrective Action Agreement as described in the memorandum, "Facility-Specific Target Levels- Hoover Voluntary Corrective Action Program" (CH2M Hill 2000k), and have been approved by USEPA. The Target Levels are concentrations of chemicals in soils or groundwater that are considered to be protective of human health and the environment, and are based on conservative, health-based criteria. For example, the Target Levels for constituents in groundwater were developed based on the Maximum Concentration Limits (MCL's) that USEPA has approved as a standard for drinking water.

The results of the analyses, and the comparisons to Target Levels, fell into three main categories:

- "non-detects" – which indicate that the chemical is either not present or that it was not identifiable given the limits of the analytical process or equipment. This result was indicated by a ND on the analytical record and can be found in the Laboratory reports contained in Hoover's Program Files.
- detections below Target Levels – which indicate that that chemical was found to be present, but was present at a concentration that did not pose an unacceptable risk to human health and the environment (as defined by the *RCRA Quality Assurance Project Plan Instructions: Appendix D, Risk-Based Screening Levels*, U.S. Environmental Protection Agency 1998). Because USEPA does not require further evaluation or action for detections below the Target Levels, these detections are not discussed within this report. These concentrations have been documented as detected in the analytical records and may be found in the Laboratory reports contained in Hoover's Program Files.
- detections above Target Levels – which indicate that further evaluation and/or action (investigation or remediation) may be warranted (refer to the memorandum "Facility-Specific Target Levels—Hoover Voluntary Environmental Corrective Action Program" (CH2M HILL 2000k) for a discussion of the background and selection of Target Levels). These detections are the focus of the remainder of this section.

Documentation of raw data will be maintained within Hoover's Program Files for a period of 6 years after the termination of the Voluntary Corrective Action Agreement.

3.1 Soil

Two hundred eighty soil samples were collected from 74 locations around the facility boundary and from 25 surface locations in the publicly accessible recreation areas on the northern portion of the facility. Table 3-1 summarizes the boring locations identifier, depths sampled, laboratory analyses performed for each sample, and the depth at which water saturated soils were encountered (likely representing the top of the groundwater table) in the boring.

A summary of the number of analyses performed, detections, and detections exceeding Target Levels for each compound is listed in Table 3-2. Of 25,663 soil analytical records, 142 detections of 22 chemicals were found at concentrations above Target Levels. These 142 detections represent approximately one-half of one percent of all the soil analyses conducted. The 22 chemicals detected at concentrations exceeding Target Levels fell within each of the major groups of chemicals on the Target Analyte and the Appendix IX lists.

Seven of the 22 compounds detected at concentrations above the Target Levels were part of the Appendix IX analytical list, that were not on the Perimeter Investigation Target Analyte List (Table 3-3). There were a total of 62 detections of these compounds at concentrations exceeding Target Levels. These results are described further, with respect to their proximity to the ground surface, below.

3.1.1 Surface Soil

Surface soil refers to soil in the 0-to-2-foot interval. If a discreet layer of surface cover material such as asphalt, concrete, gravel, or chip-and-seal material was encountered, the 0-to-2 foot sampling interval was generally started at the bottom of the cover layer. Additionally, the root mass present in sod was not sampled where present, although the soil associated with the root mass at the top of the 0-2 foot interval was sampled. Table 3-4 lists all boring locations, compounds, and concentrations for which detections exceeded the Target Level for surface soil along with the ground cover material logged in the field. The detections in surface soil at concentrations above Target Levels were generally on the northern border of the perimeter and along the western edge of the site. The number of detections at concentrations that exceeded Target Levels (67) represents less than 1 percent of the surface soil analyses.

Trichloroethene was the only VOC detected at concentrations over Target Levels in surface soil around the perimeter of the site (Figure 3-1). Trichloroethene was detected at soil borings 203 and 205, both located in the Dogwood Baseball Fields. The detections over Target Levels (2) represent less than 1 percent of the total number of surface soil analytical records for VOCs.

The following SVOCs and other organic chemicals were detected at concentrations above Target Levels in surface soil (Figure 3-2):

- Benzo(a)anthracene (Perimeter Investigation Target Analyte List)
- Benzo(a)pyrene (Perimeter Investigation Target Analyte List)
- Benzo(b)fluoranthene (Perimeter Investigation Target Analyte List)
- Benzo(g,h,i)perylene (Perimeter Investigation Target Analyte List)
- Benzo(k)fluoranthene (Perimeter Investigation Target Analyte List)
- Indeno(1,2,3-c,d)Pyrene (Perimeter Investigation Target Analyte List)
- PCB-1248 (Arochlor 1248) (Appendix IX)
- Phenanthrene (Perimeter Investigation Target Analyte List)
- Total Dioxins as 2,3,7,8- TCDD (Appendix IX)

Of the 99 locations sampled, 15 had SVOC or other organic chemical concentrations in surface soil that exceeded Target Levels. The total number of SVOC and other organic chemical detections over Target Levels represent 1 percent of the total number of surface soil analytical records for that group.

The following metals were detected at concentrations above Target Levels in surface soil (Figure 3-3):

- Arsenic (Appendix IX)
- Beryllium (Appendix IX)
- Cadmium (Perimeter Investigation Target Analyte List)
- Lead (Perimeter Investigation Target Analyte List)

Of the 99 locations sampled, 16 had metals concentrations in surface soil at concentrations above Target Levels. Concentrations of metals over Target Levels were reported in less than 2 percent of the total number of metals analytical records for surface soil.

The concentrations and distribution of chemicals detected in surface soils could not be definitively correlated to known onsite source areas or past activities. Some individual chemicals, particularly those in the SVOCs and metals groups, can be naturally occurring or associated with other sources (for example, some SVOCs are produced from combustion of fuels and are present in automobile exhaust, or can be found in asphalt). Further evaluations have been performed (see Appendix A, B, and C) or are in progress to evaluate the concentrations of these chemicals in the context of current land use and potential human health exposure. Additional further evaluations also are in progress to better understand whether the concentrations of these chemicals could be associated with past site activities or are within typical ranges reported elsewhere as naturally occurring or as derived from other sources in urban environments.

3.1.2 Subsurface Soil

Subsurface soil refers to all soil more than 2 feet below the ground surface or cover layer. All detections in subsurface soil at concentrations greater than Target Levels are listed in Table 3-5. Of the total 99 locations sampled, 74 were deep borings where subsurface soil samples were collected. Of these 74 borings, 3 (SB-108, SB-128, and SB-144) had VOCs at concentrations above Target Levels in subsurface soil (Figure 3-1). These concentrations above Target Levels represent less than 1 percent of all VOC analytical records for subsurface soil. The following VOCs, all Perimeter Investigation Target Analyte List compounds, were detected in subsurface soil at concentrations over Target Levels:

- Carbon tetrachloride
- Chloroform
- Trichloroethene
- Xylenes

Of the 74 sampling locations, 10 had SVOCs or other organic chemicals present at concentrations in subsurface soil higher than Target Levels (Figure 3-2). Less than 1 percent of the total SVOC or other organic chemicals analytical records in subsurface soil resulted in detections over Target Levels.

The following SVOCs and other organic chemicals were detected at concentrations above Target Levels in subsurface soil (Figure 3-2):

- 2-methylnapthalene (Appendix IX)
- Benzo(a)anthracene (Perimeter Investigation Target Analyte List)
- Benzo(a)pyrene (Perimeter Investigation Target Analyte List)
- Benzo(b)fluoranthene (Perimeter Investigation Target Analyte List)
- Benzo(g,h,i)perylene (Perimeter Investigation Target Analyte List)
- Bis(2-ethylhexyl)phthalate (Perimeter Investigation Target Analyte List)
- Indeno(1,2,3-c,d)pyrene (Perimeter Investigation Target Analyte List)
- Isodrin (Appendix IX)

- PCB-1248 (Arochlor 1248) (Appendix IX)
- PCB-1260 (Arochlor 1260) (Appendix IX)
- Phenanthrene (Perimeter Investigation Target Analyte List)
- Total Dioxin as 2,3,7,8 TCDD (Appendix IX)

Of the 74 sampling locations, 16 had metals present in the subsurface soil at concentrations higher than Target Levels (Figure 3-3). The concentrations exceeding Target Levels represent less than 2 percent of the total metals analytical records for subsurface soil.

The following metals were detected at concentrations above Target Levels in subsurface soils (Figure 3-3):

- Arsenic (Appendix IX)
- Beryllium (Appendix IX)
- Copper (Perimeter Investigation Target Analyte List)
- Lead (Perimeter Investigation Target Analyte List)
- Tin (Appendix IX)

Many of the chemicals detected in subsurface soils, particularly the SVOCs, other organic compounds, and metals, were the same as those found in surface soils. Similar to the surface soil results, further evaluations on the concentrations and distributions of these chemicals are in progress.

3.2 Groundwater

Groundwater samples were collected from 47 boring locations (grab samples) where sufficient water was present to collect the necessary sample volume, and from 11 of the 12 monitoring wells installed as part of the investigation. One of the investigation monitoring wells did not yield enough groundwater for sample collection. In addition to the Appendix IX or Perimeter Investigation Target Analyte List constituents, some of the grab samples were analyzed for general chemistry and treatability parameters. All monitoring well samples were analyzed for the Appendix IX constituents.

3.2.1 Groundwater Grab Sample Results

Sixty-five groundwater grab samples were collected as part of the Perimeter Investigation. Table 3-6 provides summary information (location, depth, analytes) for all groundwater samples. A summary of the number of analyses performed, detections, and detections exceeding Target Levels for each compound is listed in Table 3-7. Of 7,581 groundwater analytical records, 284 detections of 31 chemicals were found at concentrations above Target Levels. These 284 detections represent less than 4 percent of all groundwater analyses conducted.

Five of the 31 chemicals detected at concentrations above Target Levels were part of the Appendix IX analytical list, that were not on the Perimeter Investigation Target Analyte List (Table 3-8). Excluding the total metals (discussed further below), there were a total of three detections of two Appendix IX list chemicals at concentrations exceeding Target Levels.

Table 3-9 lists groundwater detections that exceeded Target Levels at both shallow and deep sample intervals. Some stations had concentrations above Target Levels for both intervals, but no vertical trends in the distribution of compounds were observed in those stations.

Of the 47 perimeter groundwater sampling locations, 11 had VOCs concentrations in groundwater greater than Target Levels. Less than 2 percent of the analytical records for VOCs resulted in detections above Target Levels (Figure 3-4).

The following VOCs, all part of the Perimeter Investigation Target Analyte List, were detected at concentrations greater than Target Levels in groundwater (Figure 3-4):

- Benzene
- Cis-1,2-dichloroethene
- Tetrachloroethene
- Trichloroethene
- Vinyl Chloride

Of the 47 perimeter groundwater sampling locations, 30 had SVOCs or other organic chemical concentrations greater than Target Levels. The SVOCs and other organic chemicals detected at concentrations exceeding Target Levels represent less than 3 percent of the total number of SVOC or other organic chemicals analytical records.

The following SVOCs or other organic chemicals were detected at concentrations above Target Levels in groundwater (Figure 3-4).

- 2-Methylnapthalene (Appendix IX)
- Benzo(a)anthracene (Perimeter Investigation Target Analyte List)
- Benzo(a)pyrene (Perimeter Investigation Target Analyte List)
- Benzo(b)fluoranthene (Perimeter Investigation Target Analyte List)
- Bis(2-ethylhexyl)phthalate (Perimeter Investigation Target Analyte List)
- Dibenzo(a,h)anthracene (Perimeter Investigation Target Analyte List)
- Indeno(1,2,3-c,d)pyrene (Perimeter Investigation Target Analyte List)
- Naphthalene (Perimeter Investigation Target Analyte List)
- PCB-1248 (Arochlor 1248) (Appendix IX)
- Phenanthrene (Perimeter Investigation Target Analyte List)

Many of the SVOCs or other organic chemicals detected in grab groundwater samples were the same as those detected in soil samples. Because these SVOCs tend to adhere strongly to soil particles, it is commonly observed that concentrations of these SVOCs can be high in grab samples that are turbid and high in suspended solids. Because the presence of these soil particles can influence the sample results, but the soil particles do not migrate in groundwater, concentrations of SVOCs observed in turbid grab sample are often biased high and are not representative of actual chemical concentrations migrating in groundwater. When less turbid samples are collected using a different method, such as from monitoring wells, these concentrations will often decrease, supporting the conclusion that the SVOC concentrations observed in the grab samples were related primarily to the presence of suspended solids in the samples, and do not represent chemical concentrations migrating in groundwater. Grab sample results were broadly compared to the groundwater results collected from monitoring wells (see Section 3.2.2), and further evaluations of these results are also in progress.

Dissolved metals were detected at concentrations greater than Target Levels at 4 of 47 sampling locations (Figure 3-5). These dissolved metals concentrations above Target Levels represent 1 percent of the total dissolved metals analytical records. Dissolved metals analyses differ slightly from total metals analyses in that the samples are filtered to remove suspended solids before analysis. Because metals tend to adhere to soils, which do not migrate in groundwater, removing the suspended solids (soils) by filtering results in a sample that is more representative of metals concentrations in groundwater that have the potential of migrating. The following metals were detected in groundwater at concentrations exceeding Target Levels (Figure 3-5):

- Dissolved cadmium (Perimeter Investigation Target Analyte List)
- Dissolved lead (Perimeter Investigation Target Analyte List)
- Dissolved nickel (Perimeter Investigation Target Analyte List)
- Dissolved thallium (Appendix IX)
- Dissolved titanium (Perimeter Investigation Target Analyte List)

Total metals data are included on the summary tables (Table 3-7 and 3-8), but not on Table 3-9 or illustrated on a figure because they are not considered to be representative of metals present and migrating in groundwater. Groundwater grab samples from the borings typically had high concentrations of suspended solids as a result of the fine-grained soils. The metals present associated with suspended solids became solubilized in the groundwater sample when the sample was preserved with nitric acid. The increase in total metals is often very substantial because metals concentrations in soil typically are several orders of magnitude greater than those in groundwater. The effect of the suspended solids was seen in nearly all groundwater grab samples. Table 3-10 lists all sampling locations where there was a detection for both dissolved and total metals in groundwater. The high ratio of total metals to dissolved metals concentrations for each compound indicates the effect of high suspended solids in the groundwater grab samples. Documentation of the total metals data can be found in the Hoover Program files.

Additional general chemistry parameters that help characterize groundwater conditions are summarized by location in Figure 3-6. These parameters will be used to evaluate the potential breakdown by natural processes of the chemicals encountered around the perimeter of the site. General chemistry parameters were measured at approximately 10 percent of the sampling locations where groundwater was sufficient to collect a sample. The figure shows all locations where general chemistry data were collected. These parameters were not measured at any locations on the eastern border of the site because most locations were dry or produced sufficient groundwater to collect only the samples required for the Perimeter Investigation Target Analyte List or Appendix IX analytical suite.

Parameters used to assess treatability are presented in Figure 3-7. Treatability parameters help to evaluate which treatment technologies will be most effective in remediating contaminated soil and groundwater, should remediation be necessary. Samples to be analyzed for treatability parameters were collected at 10 percent of the stations where groundwater was sufficient to provide a sample.

3.2.2 Groundwater Monitoring Well Sample Results

Eleven groundwater monitoring well samples were collected and analyzed for the full Appendix IX list compounds as part of the perimeter investigation (Table 3-11). The number of detections and detections that exceeded Target Levels for each compound are also listed. Of 2,721 monitoring well groundwater analytical records, 13 concentrations of 10 chemicals (less than one half of one percent) exceeded Target Levels.

Figure 3-8 displays the locations and concentrations of compounds detected at levels over Target Levels in monitoring wells. Note the decrease in the total number of SVOCs and metals reported for the monitoring well samples compared to the list of constituents reported for the grab samples (Figure 3-8). This finding is consistent with concentration trends expected as a result of a reduced amount of suspended solids (i.e., silt- and clay-sized particles) generally present in monitoring well samples as compared to groundwater grab samples.

Of the 11 wells sampled, VOCs were detected in 3. The following VOCs were detected at concentrations above Target Levels in monitoring well samples (Figure 3-8):

- cis-1,2-Dichloroethene (Perimeter Investigation Target Analyte List)
- Tetrachloroethene (Perimeter Investigation Target Analyte List)
- Trichloroethene (Perimeter Investigation Target Analyte List)
- Vinyl chloride (Perimeter Investigation Target Analyte List)

Of the 11 wells sampled, SVOCs were detected in 4. The following SVOCs were detected at concentrations above Target Levels in monitoring well samples (Figure 3-8):

- 2-Methylnaphthalene (Perimeter Investigation Target Analyte List)
- bis(2-Ethylhexyl)phthalate (Perimeter Investigation Target Analyte List)

Of the 11 wells sampled, metals were detected in 3. The following metals were present at concentrations greater than Target Levels in monitoring well samples (Figure 3-8):

- Total and dissolved cadmium (Perimeter Investigation Target Analyte List)
- Total nickel (Perimeter Investigation Target Analyte List)
- Total titanium (Perimeter Investigation Target Analyte List)

A broad comparison of chemical distribution and concentrations found in monitoring well samples and grab groundwater samples was performed. General findings related to SVOCs and metals have been discussed previously. Findings for chemicals in the VOC group, which were known to be previously used at the site, indicates that grab sample and monitoring well results are generally consistent, with the greatest number of chemicals and analytical records at concentrations above Target Levels present along the western perimeter of the site. This finding also is consistent with the geologic and hydrogeologic data indicating the predominant groundwater flow gradient is from the site towards the northwest. As a result, further evaluations of the distribution and concentrations of these compounds in groundwater are in progress.

TABLE 3-1
Soil Sample Collection Summary
Hoover Perimeter Investigation

Station ID	Depth Interval (ft) Below Ground Surface		Analyses Performed	Water Table Depth[1] (ft) Below Ground Surface
SB-107	0	2	Appendix IX	Dry
	4	6	Appendix IX	
	8	10	Appendix IX	
	12	14	Appendix IX	
	16	18	Appendix IX	
SB-108	0	2	Appendix IX	11.5
	2	4	Appendix IX	
	4	6	Appendix IX	
	8	10	Appendix IX	
SB-109	0	2	Target Analyte List	11
	2	4	Total Organic Carbon	
	4	6	Target Analyte List	
	6	8	Geotechnical	
	8	10	Target Analyte List	
	11	12	Total Organic Carbon	
	11	13	Geotechnical	
SB-110	0	2	Appendix IX	9.5
	4	6	Appendix IX	
	8	10	Appendix IX	
SB-111	0	2	Appendix IX	12
	4	6	Appendix IX	
	8	10	Appendix IX	
	12	13	Total Organic Carbon	
SB-112	0	2	Target Analyte List	16.5
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	12	14	Target Analyte List	
SB-113	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	12	14	Target Analyte List, Total Organic Carbon	
	16	18	Target Analyte List	
SB-114	0	2	Target Analyte List	16
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	12	14	Target Analyte List	
SB-115	0	2	Target Analyte List, Geotechnical	9
	4	6	Target Analyte List	
	6	8	Total Organic Carbon, Geotechnical	
	9	11	Total Organic Carbon, Geotechnical	
SB-116	0	2	Target Analyte List	8
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-117	0	2	Appendix IX	8.5
	4	6	Appendix IX	
	8	10	Appendix IX	
	12	14	Appendix IX	
SB-118	0	2	Target Analyte List	6
	2	4	Geotechnical	
	4	6	Target Analyte List, Total Organic Carbon	
SB-119	0	2	Target Analyte List	5.2
	4	6	Target Analyte List	

TABLE 3-1
Soil Sample Collection Summary
Hoover Perimeter Investigation

Station ID	Depth Interval (ft) Below Ground Surface		Analyses Performed	Water Table Depth[1] (ft) Below Ground Surface
SB-120	0	2	Target Analyte List	8
	4	6	Target Analyte List	
SB-121	0	2	Target Analyte List	12
	2	4	Total Organic Carbon	
	4	6	Target Analyte List	
SB-122	0	2	Appendix IX	6
	2	4	Geotechnical	
	4	6	Appendix IX	
	8	10	Total Organic Carbon	
SB-123	0	2	Target Analyte List	11
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-124	0	2	Target Analyte List	11
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-125	0	2	Target Analyte List	8
	4	6	Target Analyte List	
SB-126	2	4	Total Organic Carbon	8
	4	6	Target Analyte List	
	6	8	Geotechnical	
SB-127	0	2	Appendix IX	5
	4	6	Appendix IX	
SB-128	0	2	Appendix IX	10
	4	6	Appendix IX	
	8	10	Appendix IX	
SB-129	0	2	Target Analyte List	9.5
	2	4	Total Organic Carbon	
	4	6	Target Analyte List, Geotechnical	
	10	13	Geotechnical	
	12	14	Total Organic Carbon	
SB-130	0	2	Target Analyte List	11
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-131	0	2	Appendix IX	9
	4	6	Appendix IX	
SB-132	0	2	Target Analyte List	13
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-133	0	2	Appendix IX	10.5
	4	6	Appendix IX	
	8	10	Appendix IX	
SB-134	0	2	Target Analyte List	11
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-135	0	2	Appendix IX	11.5
	4	6	Appendix IX	
	8	10	Appendix IX	
SB-136	0	2	Target Analyte List	11.5
	2	4	Total Organic Carbon	
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	11	12	Total Organic Carbon	

TABLE 3-1
Soil Sample Collection Summary
Hoover Perimeter Investigation

Station ID	Depth Interval (ft) Below Ground Surface		Analyses Performed	Water Table Depth[1] (ft) Below Ground Surface
SB-137	0	2	Target Analyte List	16
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	12	14	Target Analyte List	
	16	18	Target Analyte List	
SB-138	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	12	14	Target Analyte List	
	16	18	Target Analyte List	
	18	20	Target Analyte List	
SB-139	0	2	Target Analyte List	6.8
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	12	14	Target Analyte List	
SB-140	0	2	Target Analyte List	12
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	12	14	Target Analyte List	
	16	18	Target Analyte List	
SB-141	0	2	Appendix IX	22.2
	4	6	Appendix IX	
SB-142	0	2	Target Analyte List	20
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	12	14	Target Analyte List	
SB-143	0	2	Target Analyte List	20
	4	6	TAL, Geotechnical	
	8	10	Target Analyte List	
	12	14	Target Analyte List	
	16	17	Total Organic Carbon	
	16	18	Target Analyte List	
SB-144	0	2	Target Analyte List	18.9
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	12	14	Target Analyte List	
	16	18	Target Analyte List	
SB-145	0	2	Appendix IX	Dry
	4	6	Appendix IX	
	8	10	Appendix IX	
	12	14	Appendix IX	
SB-146	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-147	0	2	Target Analyte List	12
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-148	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	12	14	Target Analyte List	
SB-149	0	2	Target Analyte List	12

TABLE 3-1
Soil Sample Collection Summary
Hoover Perimeter Investigation

Station ID	Depth Interval (ft) Below Ground Surface		Analyses Performed	Water Table Depth[1] (ft) Below Ground Surface
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-150	0	2	Appendix IX	Dry
	4	6	Appendix IX	
	8	10	Appendix IX	
SB-151	0	2	Target Analyte List	6
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	12	14	Target Analyte List	
	15	17	Geotechnical	
SB-152	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-153	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-154	0	2	Appendix IX	10
	4	6	Appendix IX	
	8	10	Appendix IX	
	10	11	Total Organic Carbon	
SB-155	0	2	Target Analyte List	11.5
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-156	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-157	0	2	Target Analyte List	Dry
	2	4	Total Organic Carbon	
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-158	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-159	0	2	Appendix IX	Dry
	4	6	Appendix IX	
	8	10	Appendix IX	
SB-160	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
SB-161	0	2	Appendix IX	Dry
	4	6	Appendix IX	
	8	10	Appendix IX	
SB-162	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-163	0	2	Target Analyte List	12.5
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	11	12	Geotechnical	
SB-164	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-165	0	2	Appendix IX	Dry

TABLE 3-1
Soil Sample Collection Summary
Hoover Perimeter Investigation

Station ID	Depth Interval (ft) Below Ground Surface		Analyses Performed	Water Table Depth[1] (ft) Below Ground Surface
	4	6	Appendix IX	
	8	10	Appendix IX	
SB-166	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	12	14	Target Analyte List	
SB-167	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	12	13	Target Analyte List	
SB-168	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	12	14	Target Analyte List	
SB-169	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
	6	8	Total Organic Carbon	
SB-170	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
SB-171	0	2	Target Analyte List	Dry
	4	6	Target Analyte List	
SB-172	0	2	Appendix IX	Dry
	4	6	Appendix IX	
	8	10	Appendix IX	
SB-173	0	2	Target Analyte List	8
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-174	0	2	Target Analyte List	14
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-175	0	2	Target Analyte List	7.5
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-176	0	2	Target Analyte List	12.9
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-177	0	2	Appendix IX	12
	4	6	Appendix IX	
	8	10	Appendix IX	
SB-178	0	2	Target Analyte List	12
	4	6	Target Analyte List	
	8	10	Target Analyte List	
SB-179	0	2	Appendix IX	13.5
	4	6	Appendix IX	
	8	10	Appendix IX	
	12	14	Appendix IX	
SB-193	0	2	Target Analyte List	28.5
	4	6	Target Analyte List	
	8	10	Target Analyte List	
	12	14	Target Analyte List	
	16	18	Target Analyte List	
	19	20	Target Analyte List	

TABLE 3-1
Soil Sample Collection Summary
Hoover Perimeter Investigation

Station ID	Depth Interval (ft) Below Ground Surface		Analyses Performed	Water Table Depth[1] (ft) Below Ground Surface
	20	22	Target Analyte List	
	24	26	Target Analyte List	
	28	30	Target Analyte List	
SB-194[2]	0	2	Target Analyte List	Dry
SB-195	0	2	Appendix IX	Dry
SB-196	0	2	Target Analyte List	Dry
SB-197	0	2	Target Analyte List	Dry
SB-198	0	2	Target Analyte List	Dry
SB-199	0	2	Target Analyte List	Dry
SB-200	0	2	Target Analyte List	Dry
SB-201	0	2	Appendix IX	Dry
SB-202	0	2	Target Analyte List	Dry
SB-203	0	2	Target Analyte List	Dry
SB-204	0	2	Target Analyte List	Dry
SB-205	0	2	Target Analyte List	Dry
SB-206	0	2	Appendix IX	Dry
SB-207	0	2	Target Analyte List	Dry
SB-208	0	2	Target Analyte List	Dry
SB-209	0	2	Target Analyte List	Dry
SB-210	0	2	Target Analyte List	Dry
SB-211	0	2	Target Analyte List	Dry
SB-212	0	2	Target Analyte List	Dry
SB-213	0	2	Target Analyte List	Dry
SB-214	0	2	Target Analyte List	Dry
SB-215	0	2	Target Analyte List	Dry
SB-216	0	2	Target Analyte List	Dry
SB-217	0	2	Appendix IX	Dry
SB-218	0	2	Target Analyte List	Dry

1 Depth where water saturated soils were encountered which likely represents the top of the groundwater table.
"Dry" : unsaturated soil sample (sample collected above water table)
2 Soil Boring 194 through Soil Boring 218 were surface borings only (0-2 ft).

TABLE 3-2
Compounds Detected in Perimeter Soil
Hoover Perimeter Investigation

Compound	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Detection (µg/kg)	Minimum Detection (µg/kg)	Mean (µg/kg)	Target Level (µg/kg)	Number of Detections > Target Level
1,1,1,2-Tetrachloroethane	66	0	0%				3,000	0
1,1,1-Trichloroethane	265	0	0%				1,200,000	0
1,1,2,2-Tetrachloroethane	66	0	0%				600	0
1,1,2-Trichloroethane	265	0	0%				1,000	0
1,1-Dichloroethene	**265**	**2**	**0.75%**	**1.6**	**0.76**	**1.18**	**70**	**0**
1,2,3-Trichloropropane	66	0	0%				5	0
1,2,4,5-Tetrachlorobenzene	66	0	0%				16,000	0
1,2,4-Trichlorobenzene	66	0	0%				780,000	0
1,2-Dibromo-3-Chloropropane	66	0	0%				300	0
1,2-Dibromoethane	66	0	0%				5	0
1,2-Dichlorobenzene	265	0	0%				560,000	0
1,2-Dichloroethane	265	0	0%				400	0
1,2-Dichloropropane	66	0	0%				9,000	0
1,3,5-Trinitrobenzene	66	0	0%				1,635,000	0
1,3-Dichlorobenzene	66	0	0%				41,000	0
1,3-Dinitrobenzene	66	0	0%				5,000	0
1,4-Dichlorobenzene	66	0	0%				27,000	0
1,4-Dioxane	66	0	0%				40,000	0
1,4-Naphthoquinone	66	0	0%				2,000	0
1-Naphthylamine	66	0	0%				330	0
2,3,4,6-Tetrachlorophenol	66	0	0%				1,635,000	0
2,4,5-T (Trichlorophenoxyacetic Acid)	66	0	0%				545,000	0
2,4,5-Trichlorophenol	66	0	0%				7,800,000	0
2,4,6-Trichlorophenol	66	0	0%				58,000	0
2,4-D (Dichlorophenoxyacetic Acid)	66	0	0%				642,000	0
2,4-Dichlorophenol	66	0	0%				230,000	0
2,4-Dimethylphenol	66	0	0%				1,600,000	0
2,4-Dinitrophenol	66	0	0%				160,000	0
2,4-Dinitrotoluene	66	0	0%				900	0
2,6-Dichlorophenol	66	0	0%				330	0
2,6-Dinitrotoluene	66	0	0%				900	0
2-Acetylaminofluorene	66	0	0%				3,300	0
2-Aminonaphthalene (Beta Naphthylamine)	66	0	0%				330	0
2-Butanone	**265**	**2**	**0.75%**	**2,200**	**37**	**1,120**	**6,860,000**	**0**
2-Chloro-1,3-Butadiene	66	0	0%				4,000	0
2-Chloronaphthalene	66	0	0%				3,675,000	0
2-Chlorophenol	66	0	0%				390,000	0
2-Hexanone	66	0	0%				20	0
2-Methylnaphthalene	**66**	**1**	**1.52%**	**640**	**640**	**640**	**330**	**1**
2-Methylphenol (O-Cresol)	66	0	0%				3,900,000	0
2-Nitroaniline	66	0	0%				3,300	0
2-Nitrophenol	66	0	0%				330	0
2-Picoline (Alpha-Picoline)	66	0	0%				660	0
3,3'-Dichlorobenzidine	66	0	0%				1,600	0
3,3'-Dimethylbenzidine	66	0	0%				1,600	0
3-Methylcholanthrene	66	0	0%				660	0
3-Methylphenol	66	0	0%				2,725,000	0
3-Nitroaniline	66	0	0%				2,000	0
4,6-Dinitro-2-Methylphenol	66	0	0%				1,600	0
4-Aminobiphenyl (4-Biphenylamine)	66	0	0%				1,600	0
4-Bromophenyl Phenyl Ether	66	0	0%				330	0
4-Chloro-3-Methylphenol	66	0	0%				330	0
4-Chloroaniline	66	0	0%				310,000	0
4-Chlorophenyl Phenyl Ether	66	0	0%				330	0
4-Methyl-2-Pentanone	**265**	**1**	**0.38%**	**0.7**	**0.7**	**0.700**	**746,000**	**0**
4-Methylphenol (P-Cresol)	66	0	0%				273,000	0
4-Nitroaniline	66	0	0%				1,600	0
4-Nitrophenol	66	0	0%				3,379,000	0
4-Nitroquinoline-N-Oxide	66	0	0%				3,300	0
5-Nitro-O-Toluidine	66	0	0%				13,000	0
7,12-Dimethylbenz(A)Anthracene	66	0	0%				660	0
Acenaphthene	**265**	**1**	**0.38%**	**1,300**	**1,300**	**1,300**	**4,700,000**	**0**
Acenaphthylene	265	0	0%				330	0
Acetone	**66**	**10**	**15.15%**	**960**	**19**	**177**	**7,800,000**	**0**
Acetonitrile	66	0	0%				201,000	0
Acetophenone	66	0	0%				500	0
Acrolein	66	0	0%				100	0
Acrylonitrile	66	0	0%				200	0
Aldrin	66	0	0%				40	0
[illegible] Chloride	66	0	0%				2,713,000	0
[illegible]a BHC (Alpha Hexachlorocyclohexane)	66	0	0%				100	0
Alpha Endosulfan	66	0	0%				1.7	0
Aniline (Phenylamine, Aminobenzene)	66	0	0%				78,000	0
Anthracene	**265**	**6**	**2.26%**	**17,000**	**940**	**4,240**	**23,000,000**	**0**
Antimony	**66**	**1**	**2%**	**7,090**	**7,090**	**7,090**	**31,000**	**0**
Aramite	66	0	0%				18,000	0

TABLE 3-2
Compounds Detected in Perimeter Soil
Hoover Perimeter Investigation

Compound	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Detection (µg/kg)	Minimum Detection (µg/kg)	Mean (µg/kg)	Target Level (µg/kg)	Number of Detections > Target Level
Arsenic	66	66	100%	101,000	2,120	15,600	13,000	33
Barium	265	255	96.23%	1,530,000	17,400	82,300	5,500,000	0
Benzene	265	1	0.38%	0	0	0.490	800	0
Benzo(A)Anthracene	265	14	5.28%	45,000	390	5,050	900	9
Benzo(A)Pyrene	265	14	5.28%	40,000	400	4,600	330	14
Benzo(B)Fluoranthene	265	15	5.66%	34,000	410	4,330	900	11
Benzo(G,H,I)Perylene	265	9	3.40%	25,000	520	4,240	330	9
Benzo(K)Fluoranthene	265	11	4.15%	31,000	430	4,050	9,000	1
Benzyl Alcohol	66	0	0%				16,351,000	0
Benzyl Butyl Phthalate	265	0	0%				930,000	0
Beryllium	66	10	15.15%	1,020	556	696	540	10
Beta BHC (Beta Hexachlorocyclohexane)	66	0	0%				400	0
Beta Endosulfan	66	0	0%				1.7	0
Bis(2-Chloroethoxy) Methane	66	0	0%				330	0
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	66	0	0%				330	0
Bis(2-Chloroisopropyl) Ether	66	0	0%				6,000	0
Bis(2-Ethylhexyl) Phthalate	265	4	1.51%	110,000	58	27,800	46,000	1
Bromodichloromethane	66	0	0%				10,000	0
Bromoform	66	0	0%				56,000	0
Bromomethane	66	0	0%				10,000	0
Cadmium	265	22	8.30%	148,000	671	17,100	78,000	1
Carbon Disulfide	265	5	1.89%	58	3.7	22.3	720,000	0
Carbon Tetrachloride	265	1	0.38%	3,100	3,100	3,100	300	1
Chlordane	66	2	3.03%	170	88	129	500	0
Chlorobenzene	265	0	0%				130,000	0
Chlorobenzilate	66	0	0%				1,600	0
Chloroethane	265	0	0%				1,600,000	0
Chloroform	265	1	0.38%	880	880	880	300	1
Chloromethane	66	0	0%				1,000	0
Chrysene	265	15	5.66%	44,000	460	4,780	88,000	0
Cis-1,2-Dichloroethene	265	8	3.02%	17,000	2.3	2,270	42,000	0
Cis-1,3-Dichloropropene	66	0	0%				5	0
Cobalt	66	58	87.88%	71,500	5,750	10,200	3,253,000	0
Copper	265	265	100%	19,500,000	5,500	139,000	2,784,000	2
Cyanide	265	4	1.51%	12.4	0.58	4.15	1,600,000	0
Delta BHC (Delta Hexachlorocyclohexane)	66	0	0%				2	0
Di-N-Butyl Phthalate	265	0	0%				2,300,000	0
Di-N-Octylphthalate	265	0	0%				1,600,000	0
Diallate	66	0	0%				7,000	0
Dibenz(A,H)Anthracene	265	0	0%				330	0
Dibenzofuran	66	0	0%				207,000	0
Dibromochloromethane	66	0	0%				8,000	0
Dibromomethane	66	0	0%				545,000	0
Dichlorodifluoromethane	265	0	0%				94,000	0
Dieldrin	66	1	1.52%	19	19	19	40	0
Diethyl Phthalate	265	1	0.38%	39,000	39,000	39,000	2,000,000	0
Dimethoate	66	0	0%				11,000	0
Dimethyl Phthalate	265	0	0%				100,000,000	0
Dinoseb	66	0	0%				55,000	0
Diphenylamine	66	0	0%				1,363,000	0
Disulfoton	66	0	0%				2,000	0
Endosulfan Sulfate	66	0	0%				1.7	0
Endrin	66	0	0%				23,000	0
Endrin Aldehyde	66	0	0%				1.7	0
Ethyl Methacrylate	66	0	0%				140,000	0
Ethyl Methanesulfonate	66	0	0%				330	0
Ethylbenzene	265	3	1.13%	8,700	480	3,760	400,000	0
Famphur	66	0	0%				33	0
Fluoranthene	265	19	7.17%	100,000	54	8,800	3,100,000	0
Fluorene	265	1	0.38%	1,500	1,500	1,500	3,100,000	0
Gamma BHC (Lindane)	66	0	0%				500	0
Heptachlor	66	0	0%				100	0
Heptachlor Epoxide	66	0	0%				70	0
Hexachlorobenzene	66	0	0%				400	0
Hexachlorobutadiene	66	0	0%				8,000	0
Hexachlorocyclopentadiene	66	0	0%				10,000	0
Hexachloroethane	66	0	0%				46,000	0
Hexachloropropene	66	0	0%				3,300	0
Indeno(1,2,3-C,D)Pyrene	265	10	3.77%	25,000	450	4,010	900	7
Iodomethane	132	0	0%				5	0
Isodrin	66	1	1.52%	2,600	4.7	1,300	3.3	2
Isophorone	66	0	0%				670,000	0
Isosafrole	66	0	0%				660	0
Kepone	66	0	0%				33	0
Lead	265	265	100%	938,000	3,770	31,800	400,000	3

TABLE 3-2
Compounds Detected in Perimeter Soil
Hoover Perimeter Investigation

Compound	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Detection (µg/kg)	Minimum Detection (µg/kg)	Mean (µg/kg)	Target Level (µg/kg)	Number of Detections > Target Level
Mercury	**264**	**31**	**11.74%**	**1,490**	**33.2**	**350**	**10,000**	**0**
Methacrylonitrile	66	0	0%				2,000	0
Methapyrilene	66	0	0%				1,600	0
Methoxychlor	66	0	0%				390,000	0
Methyl Methacrylate	66	0	0%				2,169,000	0
Methyl Methanesulfonate	66	0	0%				330	0
Methylene Chloride	**265**	**7**	**2.64%**	**530**	**5.3**	**136**	**13,000**	**0**
MPEA11	66	0	0%				55,000	0
N-Nitroso-Di-N-Butylamine	66	0	0%				330	0
N-Nitrosodi-N-Propylamine	66	0	0%				330	0
N-Nitrosodiethylamine	66	0	0%				330	0
N-Nitrosodiphenylamine	66	0	0%				130,000	0
N-Nitrosomorpholine	66	0	0%				330	0
N-Nitrosopyrrolidine	66	0	0%				330	0
Naphthalene	**265**	**1**	**0.38%**	**990**	**990**	**990**	**3,100,000**	**0**
Nickel	**265**	**265**	**100%**	**1,100,000**	**5,900**	**27,400**	**1,600,000**	**0**
Nitrobenzene	66	0	0%				39,000	0
Nitrosomethylethylamine	66	0	0%				330	0
O,O,O-Triethyl Phosphorothioate	66	0	0%				33	0
O-Toluidine	66	0	0%				2,000	0
P,P'-DDD	66	0	0%				3,000	0
P,P'-DDE	**66**	**2**	**3.03%**	**1,100**	**16**	**337**	**2,000**	**0**
P,P'-DDT	**66**	**1**	**1.52%**	**11**	**11**	**11**	**2,000**	**0**
P-Dimethylaminoazobenzene	66	0	0%				660	0
P-Phenylenediamine	66	0	0%				10,356,000	0
Parathion, Ethyl	66	0	0%				327,000	0
Parathion, Methyl	66	0	0%				14,000	0
PCB-1016 (Arochlor 1016)	66	0	0%				3,000	0
PCB-1221 (Arochlor 1221)	66	0	0%				33	0
PCB-1232 (Arochlor 1232)	66	0	0%				33	0
PCB-1242 (Arochlor 1242)	66	0	0%				33	0
PCB-1248 (Arochlor 1248)	**66**	**10**	**15.15%**	**430,000**	**66**	**71,500**	**33**	**10**
PCB-1254 (Arochlor 1254)	**66**	**1**	**1.52%**	**100**	**100**	**100**	**1,000**	**0**
PCB-1260 (Arochlor 1260)	**66**	**3**	**4.55%**	**88,000**	**81**	**54,700**	**33**	**3**
Pentachlorobenzene	66	0	0%				44,000	0
Pentachloroethane	66	0	0%				1,600	0
Pentachloronitrobenzene	66	0	0%				2,000	0
Pentachlorophenol	66	0	0%				3,000	0
Phenacetin	66	0	0%				660	0
Phenanthrene	**265**	**16**	**6.04%**	**63,000**	**410**	**6,970**	**330**	**16**
Phenol	66	0	0%				47,000,000	0
Phorate	66	0	0%				11,000	0
Pronamide	66	0	0%				4,088,000	0
Propionitrile	66	0	0%				20	0
Pyrene	**265**	**17**	**6.42%**	**93,000**	**44**	**8,730**	**2,300,000**	**0**
Pyridine	265	0	0%				55,000	0
Safrole	66	0	0%				660	0
Selenium	**66**	**37**	**56.06%**	**1,780**	**595**	**1,020**	**390,000**	**0**
Silver	**66**	**2**	**3.03%**	**24,600**	**1,390**	**13,000**	**390,000**	**0**
Silvex (2,4,5-Tp)	66	0	0%				436,000	0
Styrene	66	0	0%				1,500,000	0
Tetrachloroethene	**265**	**6**	**2.26%**	**1,500**	**11**	**268**	**11,000**	**0**
Thallium	66	0	0%				5,200	0
Thiodiphosphoric Acid Tetraethyl Ester	66	0	0%				27,000	0
Tin	**66**	**3**	**4.55%**	**51,600**	**16,600**	**32,800**	**10,000**	**3**
Titanium	**265**	**264**	**100%**	**479,000**	**20,700**	**135,000**	**4,100,000**	**0**
Toluene	**265**	**8**	**3.02%**	**1,400**	**0.59**	**511**	**650,000**	**0**
Toxaphene	66	0	0%				600	0
Trans-1,2-Dichloroethene	**265**	**1**	**0.38%**	**490**	**490**	**490**	**1,600,000**	**0**
Trans-1,3-Dichloropropene	66	0	0%				5	0
Trans-1,4-Dichloro-2-Butene	66	0	0%				5	0
Trichloroethene	**265**	**16**	**6.04%**	**18,000**	**5.6**	**2,160**	**5,000**	**3**
Trichlorofluoromethane	265	0	0%				383,000	0
Vinyl Acetate	66	0	0%				550,000	0
Vinyl Acetate	66	0	0%				1,000,000	0
Vinyl Chloride	265	0	0%				30	0
Xylenes, Total	**265**	**16**	**6.04%**	**1,200,000**	**6.5**	**103,000**	**410,000**	**1**
Zinc	**265**	**254**	**95.85%**	**17,200,000**	**15,700**	**240,000**	**23,000,000**	**0**
Total	**25663**	**2066**						**142**

TABLE 3-3
Non-Target Analyte Compounds Detected Above Target Levels in Perimeter Soil
Hoover Perimeter Investigation

Compound	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Detection (mg/kg)	Minimum Detection (mg/kg)	Mean (mg/kg)	Target Level (mg/kg)	Number of Detections > Target Level
2-Methylnaphthalene	66	1	1.52%	640	640	640	330	**1**
Arsenic	66	66	100%	101,000	2,120	15,600	13,000	**33**
Beryllium	66	10	15.15%	1,020	556	696	540	**10**
Isodrin	66	1	1.52%	2,600	4.7	1300	3.3	**2**
PCB-1248 (Arochlor 1248)	66	10	15.15%	430,000	66	71,500	33	**10**
PCB-1260 (Arochlor 1260)	66	3	4.55%	88,000	81	54,700	33	**3**
Tin	66	3	4.55%	51,600	16,600	32,800	10,000	**3**
Total	**462**	**94**						**62**

TABLE 3-4
Compounds Detected above Target Levels at Perimeter Borings in Soil, 0-2 feet
Hoover Perimeter Investigation

Station Identifier	Compound	Lab Result (µg/kg)	Target Level (µg/kg)	Ground Cover
SB-107	PCB-1248 (Arochlor 1248)	17,000	33	Gravel
SB-108	Arsenic	19,100	13,000	Gravel
SB-108	PCB-1248 (Arochlor 1248)	27,000	33	Gravel
SB-108	Total Dioxin as 2,3,7,8-TCDD	0.035	0.004	Gravel
SB-111	Isodrin	4.7	3.3	Gravel
SB-111	PCB-1248 (Arochlor 1248)	92	33	Gravel
SB-117	Arsenic	14,500	13,000	Grass
SB-122	Arsenic	16,400	13,000	Gravel
SB-127	Arsenic	14,200	13,000	Gravel
SB-128	Arsenic	20,300	13,000	Gravel
SB-130	Benzo(A)Anthracene	45,000	900	Gravel
SB-130	Benzo(A)Pyrene	40,000	330	Gravel
SB-130	Benzo(B)Fluoranthene	34,000	900	Gravel
SB-130	Benzo(G,H,I)Perylene	25,000	330	Gravel
SB-130	Benzo(K)Fluoranthene	31,000	9,000	Gravel
SB-130	Indeno(1,2,3-C,D)Pyrene	25,000	900	Gravel
SB-130	Phenanthrene	63,000	330	Gravel
SB-131	Arsenic	18,800	13,000	Gravel
SB-132	Benzo(A)Pyrene	490	330	Asphalt
SB-132	Phenanthrene	530	330	Asphalt
SB-135	Arsenic	17,200	13,000	Gravel
SB-141	Arsenic	15,700	13,000	Grass
SB-146	Benzo(A)Pyrene	400	330	Grass
SB-146	Phenanthrene	410	330	Grass
SB-148	Benzo(A)Pyrene	870	330	Grass
SB-148	Benzo(B)Fluoranthene	1,200	900	Grass
SB-148	Benzo(G,H,I)Perylene	610	330	Grass
SB-148	Phenanthrene	1,900	330	Grass
SB-153	Benzo(A)Anthracene	1,400	900	Grass
SB-153	Benzo(A)Pyrene	1,600	330	Grass
SB-153	Benzo(B)Fluoranthene	2,200	900	Grass
SB-153	Phenanthrene	2,200	330	Grass
SB-154	Arsenic	13,100	13,000	Asphalt
SB-154	Phenanthrene	430	330	Asphalt
SB-159	Benzo(A)Pyrene	530	330	Grass
SB-159	Phenanthrene	1,100	330	Grass
SB-161	Arsenic	13,100	13,000	Grass
SB-165	Benzo(A)Anthracene	1,100	900	Grass
SB-165	Benzo(A)Pyrene	950	330	Grass
SB-165	Benzo(B)Fluoranthene	1,400	900	Grass
SB-165	Phenanthrene	1,100	330	Grass
SB-177	Arsenic	16,200	13,000	Grass
SB-179	PCB-1248 (Arochlor 1248)	340	33	Gravel
SB-201	Arsenic	13,800	13,000	Grass
SB-203	Benzo(A)Anthracene	1,800	900	Grass
SB-203	Benzo(A)Pyrene	1,600	330	Grass
SB-203	Benzo(B)Fluoranthene	2,100	900	Grass
SB-203	Benzo(G,H,I)Perylene	900	330	Grass
SB-203	Indeno(1,2,3-C,D)Pyrene	1,000	900	Grass
SB-203	Phenanthrene	3,500	330	Grass
SB-203	Trichloroethene	5,100	5,000	Grass
SB-204	Benzo(A)Anthracene	2,500	900	Grass
SB-204	Benzo(A)Pyrene	2,100	330	Grass
SB-204	Benzo(B)Fluoranthene	3,000	900	Grass
SB-204	Benzo(G,H,I)Perylene	1,400	330	Grass

TABLE 3-4

Compounds Detected above Target Levels at Perimeter Borings in Soil, 0-2 feet

Hoover Perimeter Investigation

Station Identifier	Compound	Lab Result (µg/kg)	Target Level (µg/kg)	Ground Cover
SB-204	Indeno(1,2,3-C,D)Pyrene	1,500	900	Grass
SB-204	Phenanthrene	5,200	330	Grass
SB-205	Benzo(A)Anthracene	3,800	900	Grass
SB-205	Benzo(A)Pyrene	3,300	330	Grass
SB-205	Benzo(B)Fluoranthene	4,200	900	Grass
SB-205	Benzo(G,H,I)Perylene	1,900	330	Grass
SB-205	Indeno(1,2,3-C,D)Pyrene	2,200	900	Grass
SB-205	Lead	462,000	400,000	Grass
SB-205	Phenanthrene	8,600	330	Grass
SB-205	Trichloroethene	6,600	5,000	Grass
SB-206	Beryllium	1,020	540	Grass
SB-216	Cadmium	148,000	78,000	Grass
SB-217	Arsenic	13,500	13,000	Gravel

TABLE 3-5
Compounds Detected above Target Levels at Perimeter Borings in Subsurface Soil
Hoover Perimeter Investigation

Station ID	Depth Interval	Compound	LabResult (µg/kg)	Target Level (µg/kg)
SB-107	4-6	Beryllium	896	540
SB-107	8-10	PCB-1248 (Arochlor 1248)	99	33
SB-108	2-4	Arsenic	13,000	13,000
SB-108	2-4	Bis(2-Ethylhexyl) Phthalate	110,000	46,000
SB-108	2-4	Copper	3,410,000	2,784,000
SB-108	2-4	Isodrin	2,600	3.3
SB-108	2-4	Lead	742,000	400,000
SB-108	2-4	PCB-1248 (Arochlor 1248)	240,000	33
SB-108	2-4	PCB-1260 (Arochlor 1260)	76,000	33
SB-108	2-4	Tin	51,600	10,000
SB-108	2-4	Total Dioxin as 2,3,7,8-TCDD	1.0	0.004
SB-108	2-4	Xylenes, Total	1,200,000	410,000
SB-108	4-6	Arsenic	37,300	13,000
SB-108	4-6	Lead	938,000	400,000
SB-108	4-6	PCB-1248 (Arochlor 1248)	430,000	33
SB-108	4-6	PCB-1260 (Arochlor 1260)	88,000	33
SB-108	4-6	Tin	16,600	10,000
SB-108	8-10	PCB-1248 (Arochlor 1248)	81	33
SB-111	4-6	Arsenic	13,800	13,000
SB-111	8-10	Arsenic	17,300	13,000
SB-111	8-10	PCB-1248 (Arochlor 1248)	66	33
SB-127	4-6	Arsenic	77,500	13,000
SB-127	4-6	Beryllium	618	540
SB-128	4-6	2-Methylnaphthalene	640	330
SB-128	4-6	Arsenic	33,200	13,000
SB-128	4-6	Beryllium	696	540
SB-128	4-6	PCB-1260 (Arochlor 1260)	81	33
SB-128	4-6	Tin	30,300	10,000
SB-128	4-6	Trichloroethene	18,000	5,000
SB-130	4-6	Benzo(A)Anthracene	4,500	900
SB-130	4-6	Benzo(A)Pyrene	4,900	330
SB-130	4-6	Benzo(B)Fluoranthene	3,400	900
SB-130	4-6	Benzo(G,H,I)Perylene	3,200	330
SB-130	4-6	Copper	19,500,000	2,784,000
SB-130	4-6	Indeno(1,2,3-C,D)Pyrene	3,400	900
SB-130	4-6	Phenanthrene	8,500	330
SB-132	4-6	Benzo(A)Anthracene	2,800	900
SB-132	4-6	Benzo(A)Pyrene	2,400	330
SB-132	4-6	Benzo(B)Fluoranthene	3,100	900
SB-132	4-6	Benzo(G,H,I)Perylene	1,200	330
SB-132	4-6	Indeno(1,2,3-C,D)Pyrene	1,400	900
SB-132	4-6	Phenanthrene	4,400	330
SB-133	4-6	Arsenic	13,300	13,000
SB-135	4-6	Arsenic	19,000	13,000
SB-135	8-10	Arsenic	15,500	13,000
SB-141	4-6	Arsenic	20,100	13,000
SB-144	16-18	Carbon Tetrachloride	3,100	300
SB-144	16-18	Chloroform	880	300
SB-145	12-14	Arsenic	15,700	13,000
SB-146	8-10	Benzo(A)Pyrene	780	330
SB-146	8-10	Benzo(B)Fluoranthene	1,100	900

TABLE 3-5
Compounds Detected above Target Levels at Perimeter Borings in Subsurface Soil
Hoover Perimeter Investigation

Station ID	Depth Interval	Compound	LabResult (μg/kg)	Target Level (μg/kg)
SB-146	8-10	Benzo(G,H,I)Perylene	520	330
SB-146	8-10	Phenanthrene	1,900	330
SB-154	4-6	Arsenic	14,500	13,000
SB-154	8-10	Arsenic	34,900	13,000
SB-154	8-10	Benzo(A)Anthracene	4,400	900
SB-154	8-10	Benzo(A)Pyrene	4,500	330
SB-154	8-10	Benzo(B)Fluoranthene	6,900	900
SB-154	8-10	Benzo(G,H,I)Perylene	3,400	330
SB-154	8-10	Indeno(1,2,3-C,D)Pyrene	3,900	900
SB-154	8-10	Phenanthrene	8,300	330
SB-155	8-10	Phenanthrene	440	330
SB-161	4-6	Arsenic	17,500	13,000
SB-161	4-6	Beryllium	600	540
SB-165	4-6	Arsenic	13,100	13,000
SB-165	8-10	Arsenic	14,400	13,000
SB-165	8-10	Beryllium	577	540
SB-172	4-6	Arsenic	14,500	13,000
SB-172	4-6	Beryllium	556	540
SB-172	8-10	Beryllium	774	540
SB-177	4-6	Arsenic	13,000	13,000
SB-177	8-10	Arsenic	101,000	13,000
SB-179	12-14	Beryllium	635	540
SB-179	4-6	PCB-1248 (Arochlor 1248)	140	33
SB-179	8-10	Arsenic	16,700	13,000
SB-179	8-10	Beryllium	586	540

TABLE 3-6
Groundwater Grab Sample Collection Summary
Hoover Perimeter Investigation

StationId	Upper Screened Depth (feet)	Adjusted Upper Sample Depth (feet)	Lower Screened Depth (feet)	Analyses Performed	Water Table Depth (feet)[1]	Soil Boring Depth (feet)
SB-108	14		16	Appendix IX, Treatability	11.5	22
SB-109	12		16	Target Analyte List, Natural Attenuation	11	20.8
SB-110	14		16	Appendix IX	9.5	21
SB-111	11	12	16	Appendix IX	12	21.8
SB-112	8	16.5	18	Target Analyte List	16.5	18.5
SB-114	18		20	Target Analyte List VOCs, Metals, Dissolved Metals	16	18.9
SB-115	6	9	16	Target Analyte List, Natural Attenuation	9	22
SB-115	18		20	Target Analyte List, Natural Attenuation	9	22
SB-116	4	8	14	Target Analyte List, Treatabilty	8	14.3
SB-117	6	8.5	16	Appendix IX VOCs	8.5	16.5
SB-118	4	6	6	Target Analyte List	6	22
SB-118	20		22	Target Analyte List	6	22
SB-119	6		10	Target Analyte List	5.2	18
SB-119	16		18	Target Analyte List	5.2	18
SB-120	10		22	Target Analyte List, Treatabilty	8	22.7
SB-121	10	12	18	Target Analyte List, Natural Attenuation	12	18
SB-122	8		10	Appendix IX	6	25.5
SB-122	8		25	Appendix IX	6	25.5
SB-123	12		14	Target Analyte List	11	30
SB-123	20		22	Target Analyte List, Natural Attenuation	11	30
SB-124	10	11	12	Target Analyte List	11	33.8
SB-124	32		33	Target Analyte List	11	33.8
SB-125	8		10	Target Analyte List, Treatabilty	8	32
SB-125	25		27	Target Analyte List, Treatabilty	8	32
SB-126	6	8	8	Target Analyte List, Natural Attenuation	8	40
SB-126	38		40	Target Analyte List, Natural Attenuation	8	40
SB-127	6		8	Appendix IX, Natural Attenuation	5	37
SB-127	35		37	Appendix IX, Natural Attenuation	5	37
SB-128	10		12	Appendix IX	10	35
SB-128	10		35	Appendix IX	10	35
SB-129	10		15	Target Analyte List, Natural Attenuation	9.5	37
SB-129	10		34	Target Analyte List, Natural Attenuation	9.5	37
SB-130	12		14	Target Analyte List, Treatabilty	11	30.1
SB-130	26		28	Target Analyte List, Treatabilty	11	30.1
SB-131	10		14	Appendix IX	9	23
SB-131	12		14	Appendix IX VOCs, SVOCs, OPPs, PAHs	9	23
SB-131	18		21	Appendix IX	9	23
SB-132	14		16	Target Analyte List	13	28.1
SB-132	25		27	Target Analyte List	13	28.1
SB-133	6	10.5	16	Appendix IX	10.5	23.3
SB-133	22		24	Appendix IX	10.5	23.3
SB-134	6	11	16	Target Analyte List	11	26.8
SB-135	10	11.5	20	Appendix IX	11.5	20.7
SB-139	17		18	Target Analyte List, Natural Attenuation	6.8	17.8
SB-140	10	12	12	Target Analyte List	12	16.9
SB-140	17		18	Target Analyte List	12	16.9
SB-141	6	22.2	8	Appendix IX	22.2	22.6
SB-141	10	22.2	12	Appendix IX Metals	22.2	22.6
SB-141	22	22.2	23	Appendix IX VOCs, SVOCs	22.2	22.6
SB-142	20		21	Target Analyte List VOCs, SVOCs	20	21
SB-143	21		22	Target Analyte List	20	21.2
SB-144	17	18.9	18	Target Analyte List	18.9	18.9
SB-147	5	12	15	Target Analyte List VOCs, SVOCs	12	14.5
SB-151	15		20	Target Analyte List	6	21.5
SB-154	1	10	11	Appendix IX	10	11
SB-155	8	11.5	13	Target Analyte List	11.5	13
SB-163	10	12.5	15	Target Analyte List	12.5	15
SB-173	12		16	Target Analyte List VOCs	8	21
SB-173	19		21	Target Analyte List VOCs, SVOCs	8	21
SB-175	10		15	Target Analyte List VOCs	7.5	15.5
SB-176	14		24	Target Analyte List, Treatabilty	12.9	24.5
SB-177	5	12	15	Appendix IX	12	15.5
SB-178	3	12	13	Target Analyte List	12	13.5
SB-179	8	13.5	18	Appendix IX	13.5	18
SB-193	20	28.5	30	Target Analyte List	28.5	30

VOCs - Volatile Organic Carbons
SVOCs - Semi-Volatile Organic Carbons
OPPs - OrganoPhosPhosphorous Compounds
PAHs - Poly-Aromatic Hydrocarbons
1 Depth where water saturated soils were encountered which likely represents the top of the groundwater table.

TABLE 3-7
Compounds Detected in Perimeter Groundwater Grab Samples
Hoover Perimeter Investigation

Compound	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Detection (µg/l)	Minimum Detection (µg/l)	Mean (µg/l)	Target Level (µg/l)	Number of Detections > Target Level
1,1,1,2-Tetrachloroethane	21	0	0%				1	0
1,1,1-Trichloroethane	**64**	**1**	**2%**	**45**	**45**	**45**	**200**	**0**
1,1,2,2-Tetrachloroethane	21	0	0%				1	0
1,1,2-Trichloroethane	64	0	0%				5	0
1,1-Dichloroethene	**64**	**1**	**2%**	**1.9**	**1.9**	**1.9**	**7**	**0**
1,2,3-Trichloropropane	21	0	0%				1	0
1,2,4,5-Tetrachlorobenzene	20	0	0%				10	0
1,2,4-Trichlorobenzene	21	0	0%				70	0
1,2-Dibromo-3-Chloropropane	21	0	0%				2	0
1,2-Dibromoethane	21	0	0%				1	0
1,2-Dichlorobenzene	60	0	0%				600	0
1,2-Dichloroethane	64	0	0%				5	0
1,2-Dichloropropane	21	0	0%				5	0
1,3,5-Trinitrobenzene	20	0	0%				1,000	0
1,3-Dichlorobenzene	20	0	0%				20	0
1,3-Dinitrobenzene	20	0	0%				10	0
1,4-Dichlorobenzene	20	0	0%				80	0
1,4-Dioxane	21	0	0%				200	0
1,4-Naphthoquinone	20	0	0%				50	0
1-Naphthylamine	20	0	0%				10	0
2,3,4,6-Tetrachlorophenol	20	0	0%				1,000	0
2,4,5-T (Trichlorophenoxyacetic Acid)	18	0	0%				400	0
2,4,5-Trichlorophenol	20	0	0%				4,000	0
2,4,6-Trichlorophenol	20	0	0%				10	0
2,4-D (Dichlorophenoxyacetic Acid)	18	0	0%				70	0
2,4-Dichlorophenol	20	0	0%				100	0
2,4-Dimethylphenol	20	0	0%				730	0
2,4-Dinitrophenol	20	0	0%				70	0
2,4-Dinitrotoluene	20	0	0%				70	0
2,6-Dichlorophenol	20	0	0%				10	0
2,6-Dinitrotoluene	20	0	0%				40	0
2-Acetylaminofluorene	20	0	0%				100	0
2-Aminonaphthalene (Beta Naphthylamine)	20	0	0%				10	0
2-Butanone	64	0	0%				2,000	0
2-Chloro-1,3-Butadiene	21	0	0%				10.0	0
2-Chloronaphthalene	20	0	0%				500	0
2-Chlorophenol	20	0	0%				40.0	0
2-Hexanone	21	0	0%				10	0
2-Methylnaphthalene	**65**	**38**	**58%**	**26**	**0.023**	**3.277**	**0.02**	**38**
2-Methylphenol (O-Cresol)	20	0	0%				2,000	0
2-Nitroaniline	20	0	0%				50	0
2-Nitrophenol	20	0	0%				10	0
2-Picoline (Alpha-Picoline)	20	0	0%				20	0
3,3'-Dichlorobenzidine	20	0	0%				50	0
3,3'-Dimethylbenzidine	20	0	0%				50	0
3-Methylcholanthrene	65	0	0%				0.5	0
3-Methylphenol	20	0	0%				2,000	0
3-Nitroaniline	20	0	0%				50	0
4,6-Dinitro-2-Methylphenol	20	0	0%				50	0
4-Aminobiphenyl (4-Biphenylamine)	20	0	0%				50	0
4-Bromophenyl Phenyl Ether	20	0	0%				10	0
4-Chloro-3-Methylphenol	20	0	0%				10	0
4-Chloroaniline	20	0	0%				100	0
4-Chlorophenyl Phenyl Ether	20	0	0%				10	0
4-Methyl-2-Pentanone	64	0	0%				200	0
4-Methylphenol (P-Cresol)	20	0	0%				200	0
4-Nitroaniline	20	0	0%				50	0
4-Nitrophenol	21	0	0%				2,000	0
4-Nitroquinoline-N-Oxide	20	0	0%				100	0
5-Nitro-O-Toluidine	20	0	0%				20	0
7,12-Dimethylbenz(A)Anthracene	65	0	0%				0.5	0
Acenaphthene	60	0	0%				400	0
Acenaphthylene	60	0	0%				10	0
Acetone	**21**	**3**	**14%**	**92**	**11**	**49.3**	**600**	**0**
Acetonitrile	21	0	0%				70.0	0
Acetophenone	20	0	0%				10	0

TABLE 3-7
Compounds Detected in Perimeter Groundwater Grab Samples
Hoover Perimeter Investigation

Compound	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Detection (μg/l)	Minimum Detection (μg/l)	Mean (μg/l)	Target Level (μg/l)	Number of Detections > Target Level
Acrolein	21	0	0%				20	0
Acrylonitrile	21	0	0%				20	0
Aldrin	18	0	0%				0.05	0
Allyl Chloride	21	0	0%				2,000	0
Alpha BHC (Alpha Hexachlorocyclohexane)	18	0	0%				0.05	0
Alpha Endosulfan	18	0	0%				0.05	0
Aniline (Phenylamine, Aminobenzene)	20	0	0%				10.0	0
Anthracene	60	0	0%				2,000	0
Dissolved Antimony	18	0	0%				60	0
Total Antimony	15	0	0%				60	0
Aramite	20	0	0%				20	0
Dissolved Arsenic	18	3	17%	26.7	17	21.4	50	0
Total Arsenic	18	14	78%	1,640	13.6	212	50	8
Dissolved Barium	56	17	30%	519	207	316	2,000	0
Total Barium	56	38	68%	5,910	211	1,770	2,000	12
Benzene	64	3	5%	24	1	9.57	5	1
Benzo(A)Anthracene	78	8	10%	0.58	0.032	0.194	0.09	5
Benzo(A)Pyrene	78	9	12%	0.73	0.033	0.215	0.2	4
Benzo(B)Fluoranthene	78	11	14%	0.94	0.021	0.219	0.09	6
Benzo(G,H,I)Perylene	78	15	19%	1.9	0.020	0.428	10	0
Benzo(K)Fluoranthene	78	2	3%	0.13	0.026	0.078	0.9	0
Benzyl Alcohol	20	0	0%				11,000	0
Benzyl Butyl Phthalate	60	0	0%				7,000	0
Dissolved Beryllium	18	0	0%				5	0
Total Beryllium	18	6	33%	47.7	5.1	16.9	5	6
Beta BHC (Beta Hexachlorocyclohexane)	18	0	0%				0.05	0
Beta Endosulfan	18	0	0%				0.05	0
Bis(2-Chloroethoxy) Methane	20	0	0%				10	0
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	20	0	0%				10	0
Bis(2-Chloroisopropyl) Ether	20	0	0%				10	0
Bis(2-Ethylhexyl) Phthalate	60	6	10%	23	10	17.2	10	6
Bromodichloromethane	21	0	0%				100	0
Bromoform	21	0	0%				100	0
Bromomethane	21	0	0%				9.00	0
Dissolved Cadmium	55	1	2%	436	436	436	5	1
Total Cadmium	56	9	16%	262	5.7	45.3	5	9
Carbon Disulfide	64	2	3%	2	1.5	1.75	1,000	0
Carbon Tetrachloride	64	0	0%				5	0
Chlordane	18	0	0%				2	0
Chlorobenzene	64	0	0%				40.0	0
Chlorobenzilate	38	0	0%				10	0
Chloroethane	64	0	0%				9,000	0
Chloroform	64	0	0%				100	0
Chloromethane	21	0	0%				2	0
Chrysene	78	17	22%	1.2	0.02	0.252	9	0
Cis-1,2-Dichloroethene	64	24	38%	4,900	0.51	463	70	9
Cis-1,3-Dichloropropene	21	0	0%				1	0
Dissolved Cobalt	18	0	0%				2,000	0
Total Cobalt	18	7	39%	840	59.1	324	2,000	0
Dissolved Copper	56	8	14%	146	25	73	1,000	0
Total Copper	56	40	71%	3,750	25	608	1,000	5
Cyanide	54	0	0%				200	0
Delta BHC (Delta Hexachlorocyclohexane)	18	0	0%				0.05	0
Di-N-Butyl Phthalate	60	0	0%				4,000	0
Di-N-Octylphthalate	60	0	0%				700	0
Diallate	38	0	0%				20	0
Dibenz(A,H)Anthracene	78	2	3%	0.12	0.027	0.073	0.02	2
Dibenzofuran	20	0	0%				20	0
Dibromochloromethane	21	0	0%				1	0
Dibromomethane	21	0	0%				400	0
hlorodifluoromethane	64	0	0%				400	0
ldrin	18	0	0%				0.05	0
Diethyl Phthalate	60	0	0%				29,000	0
Dimethoate	20	0	0%				20	0
Dimethyl Phthalate	60	0	0%				365,000	0
Dinoseb	20	0	0%				20	0

TABLE 3-7
Compounds Detected in Perimeter Groundwater Grab Samples
Hoover Perimeter Investigation

Compound	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Detection (µg/l)	Minimum Detection (µg/l)	Mean (µg/l)	Target Level (µg/l)	Number of Detections > Target Level
Diphenylamine	20	0	0%				900	0
Disulfoton	19	0	0%				50	0
Endosulfan Sulfate	18	0	0%				0.05	0
Endrin	18	0	0%				2	0
Endrin Aldehyde	18	0	0%				0.05	0
Ethyl Methacrylate	21	0	0%				500	0
Ethyl Methanesulfonate	20	0	0%				10	0
Ethylbenzene	64	0	0%				700	0
Famphur	19	0	0%				1	0
Fluoranthene	60	0	0%				1,000	0
Fluorene	61	0	0%				200	0
Gamma BHC (Lindane)	18	0	0%				0.05	0
Heptachlor	18	0	0%				0.4	0
Heptachlor Epoxide	18	0	0%				0.2	0
Hexachlorobenzene	20	0	0%				10	0
Hexachlorobutadiene	20	0	0%				10	0
Hexachlorocyclopentadiene	20	0	0%				50	0
Hexachloroethane	20	0	0%				10	0
Hexachloropropene	20	0	0%				100	0
Indeno(1,2,3-C,D)Pyrene	**78**	**9**	**12%**	**0.51**	**0.024**	**0.172**	**0.09**	**4**
Iodomethane	42	0	0%				1	0
Isodrin	18	0	0%				0.1	0
Isophorone	20	0	0%				70	0
Isosafrole	20	0	0%				20	0
Kepone	18	0	0%				1	0
Dissolved Lead	**56**	**5**	**9%**	**25.2**	**3**	**10.8**	**15**	**1**
Total Lead	**56**	**54**	**96%**	**2,490**	**3**	**305**	**15**	**44**
Dissolved Mercury	**56**	**1**	**2%**	**0.47**	**0.47**	**0.470**	**2**	**0**
Total Mercury	**58**	**24**	**41%**	**16.5**	**0.25**	**2.7**	**2**	**9**
Methacrylonitrile	21	0	0%				1	0
Methapyrilene	20	0	0%				50	0
Methoxychlor	18	0	0%				40	0
Methyl Methacrylate	21	0	0%				1,000	0
Methyl Methanesulfonate	20	0	0%				10	0
Methylene Chloride	64	0	0%				4	0
MPEA11	20	0	0%				50	0
N-Nitroso-Di-N-Butylamine	20	0	0%				10	0
N-Nitrosodi-N-Propylamine	20	0	0%				10	0
N-Nitrosodiethylamine	20	0	0%				10	0
N-Nitrosodiphenylamine	20	0	0%				10.0	0
N-Nitrosomorpholine	20	0	0%				10	0
N-Nitrosopyrrolidine	20	0	0%				10	0
Naphthalene	**77**	**16**	**21%**	**210**	**0.048**	**16.5**	**6**	**4**
Dissolved Nickel	**56**	**6**	**11%**	**1,300**	**40**	**271**	**100**	**1**
Total Nickel	**56**	**35**	**63%**	**2,460**	**42.9**	**642**	**100**	**30**
Nitrobenzene	20	0	0%				10	0
Nitrosomethylethylamine	20	0	0%				10	0
O,O,O-Triethyl Phosphorothioate	19	0	0%				1	0
O-Toluidine	20	0	0%				20	0
P,P'-Ddd	18	0	0%				0.3	0
P,P'-Dde	18	0	0%				0.2	0
P,P'-Ddt	18	0	0%				0.2	0
P-Dimethylaminoazobenzene	20	0	0%				20	0
P-Phenylenediamine	20	0	0%				7,000	0
Parathion, Ethyl	19	0	0%				219	0
Parathion, Methyl	19	0	0%				9.125	0
Pcb-1016 (Arochlor 1016)	18	0	0%				1	0
Pcb-1221 (Arochlor 1221)	18	0	0%				1	0
Pcb-1232 (Arochlor 1232)	18	0	0%				1	0
Pcb-1242 (Arochlor 1242)	18	0	0%				1	0
[illegible]-1248 (Arochlor 1248)	**18**	**2**	**11%**	**2.6**	**2.1**	**2.35**	**1**	**2**
-1254 (Arochlor 1254)	18	0	0%				1	0
Pcb-1260 (Arochlor 1260)	18	0	0%				1	0
Pentachlorobenzene	20	0	0%				30	0
Pentachloroethane	20	0	0%				50	0
Pentachloronitrobenzene	20	0	0%				50	0

TABLE 3-7
Compounds Detected in Perimeter Groundwater Grab Samples
Hoover Perimeter Investigation

Compound	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Detection (µg/l)	Minimum Detection (µg/l)	Mean (µg/l)	Target Level (µg/l)	Number of Detections > Target Level
Pentachlorophenol	20	0	0%				10	0
Phenacetin	20	0	0%				20	0
Phenanthrene	60	1	2%	57	57	57	10	1
Phenol	21	0	0%				22,000	0
Phorate	19	0	0%				7.3	0
Pronamide	20	0	0%				3,000	0
Propionitrile	21	0	0%				4	0
Pyrene	60	0	0%				200	0
Pyridine	60	0	0%				40	0
Safrole	20	0	0%				20	0
Dissolved Selenium	18	0	0%				50	0
Total Selenium	18	4	22%	26.8	5.6	12.7	50	0
Dissolved Silver	17	0	0%				200	0
Total Silver	17	0	0%				200	0
Silvex (2,4,5-Tp)	18	0	0%				300	0
Styrene	21	0	0%				100	0
Tetrachlorinated Dibenzo-P-Dioxins, (Total)	16	0	0%				0.0007	0
Tetrachloroethene	64	6	9%	760	2.9	168	5	5
Dissolved Thallium	18	1	6%	11.8	11.8	11.8	10	1
Total Thallium	18	1	6%	66.6	66.6	66.6	10	1
Thiodiphosphoric Acid Tetraethyl Ester	19	0	0%				18.25	0
Dissolved Tin	18	0	0%				100	0
Total Tin	18	0	0%				100	0
Dissolved Titanium	56	3	5%	103	75.6	86.1	50	3
Total Titanium	56	47	84%	2320	59.1	527	50	47
Toluene	64	4	6%	6.2	1.2	2.88	1000	0
Toxaphene	18	0	0%				3	0
trans-1,2-Dichloroethene	64	3	5%	0.78	0.5	0.650	100	0
trans-1,3-Dichloropropene	21	0	0%				1	0
trans-1,4-Dichloro-2-Butene	21	0	0%				1	0
Trichloroethene	64	11	17%	680	1	141	5	8
Trichlorofluoromethane	64	0	0%				1,000	0
Vinyl Acetate	21	0	0%				256	0
Vinyl Acetate	21	0	0%				400	0
Vinyl Chloride	64	6	9%	1,400	3.3	378	2	6
Xylenes, Total	64	3	5%	2.1	1.5	1.8	10,000	0
Dissolved Zinc	56	12	21%	3,810	20.0	87	5,000	0
Total Zinc	56	42	75%	15,000	21.6	2,020	5,000	5
Total	7581	581						284

Table 3-8
·· n-Target Analyte Compounds Detected Above Target Levels in Perimeter Groundwater Grab Samples
..ɔover Perimeter Investigation

Compound	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Detection (mg/kg)	Minimum Detection (mg/kg)	Mean (mg/kg)	Target Level (mg/kg)	Number of Detections > Target Level
Dissolved Thallium	18	1	6%	11.8	11.8	11.8	10	1
Pcb-1248 (Arochlor 1248)	18	2	11%	2.6	2.1	2.35	1	2
Total Arsenic	18	14	78%	1,640	13.6	212	50	8
Total Beryllium	18	6	33%	47.7	5.1	16.9	5	6
Total Thallium	18	1	6%	66.6	66.6	66.6	10	1
Total	**90**	**24**						**18**

TABLE 3-9
Compounds Detected above Target Levels in Perimeter Groundwater Grab Samples
Hoover Perimeter Investigation

Station ID	Depth Interval	Compound	Lab Result (ug/L)	Target Level
SB-108	14-16	2-Methylnaphthalene	0.055	0.02
SB-108	14-16	PCB-1248 (Arochlor 1248)	2.6	1
SB-109	12-16	2-Methylnaphthalene	0.058	0.02
SB-110	14-16	PCB-1248 (Arochlor 1248)	2.1	1
SB-110	14-16	Vinyl Chloride	3.3	2
SB-115	06-16	2-Methylnaphthalene	0.064	0.02
SB-115	18-20	2-Methylnaphthalene	1.2	0.02
SB-116	04-14	2-Methylnaphthalene	1	0.02
SB-118	04-06	2-Methylnaphthalene	0.16	0.02
SB-118	20-22	2-Methylnaphthalene	6.9	0.02
SB-118	20-22	Benzo(A)Anthracene	0.58	0.09
SB-118	20-22	Benzo(A)Pyrene	0.73	0.2
SB-118	20-22	Benzo(B)Fluoranthene	0.94	0.09
SB-118	20-22	Indeno(1,2,3-C,D)Pyrene	0.51	0.09
SB-119	16-18	2-Methylnaphthalene	0.28	0.02
SB-119	16-18	Dissolved Titanium	75.6	50
SB-120	10-22	2-Methylnaphthalene	0.12	0.02
SB-121	10-18	2-Methylnaphthalene	0.22	0.02
SB-121	10-18	Benzene	24	5
SB-122	08-10	2-Methylnaphthalene	0.15	0.02
SB-122	08-25	2-Methylnaphthalene	0.8	0.02
SB-122	08-25	Benzo(B)Fluoranthene	0.096	0.09
SB-122	08-25	Bis(2-Ethylhexyl) Phthalate	18	10
SB-123	12-14	2-Methylnaphthalene	0.79	0.02
SB-123	20-22	2-Methylnaphthalene	0.69	0.02
SB-124	10-12	2-Methylnaphthalene	0.077	0.02
SB-124	32-33	2-Methylnaphthalene	4.6	0.02
SB-125	08-10	2-Methylnaphthalene	0.12	0.02
SB-125	08-10	Bis(2-Ethylhexyl) Phthalate	23	10
SB-125	08-10	Dissolved Cadmium	436	5
SB-125	08-10	Dissolved Nickel	1300	100
SB-125	08-10	Dissolved Titanium	103	50
SB-125	08-10	Tetrachloroethene	17	5
SB-125	08-10	Trichloroethene	6.2	5
SB-125	25-27	2-Methylnaphthalene	26	0.02
SB-126	06-08	Trichloroethene	21	5
SB-126	38-40	2-Methylnaphthalene	4.9	0.02
SB-126	38-40	Benzo(A)Anthracene	0.22	0.09
SB-126	38-40	Benzo(A)Pyrene	0.24	0.2
SB-126	38-40	Benzo(B)Fluoranthene	0.46	0.09
SB-126	38-40	Bis(2-Ethylhexyl) Phthalate	10	10
SB-126	38-40	Indeno(1,2,3-C,D)Pyrene	0.23	0.09
SB-127	06-08	Cis-1,2-Dichloroethene	390	70
SB-127	06-08	Vinyl Chloride	42	2
SB-127	35-37	2-Methylnaphthalene	26	0.02
SB-127	35-37	Benzo(B)Fluoranthene	0.22	0.09
SB-127	35-37	Naphthalene	18	6
SB-127	35-37	Vinyl Chloride	5.5	2
SB-128	10-12	2-Methylnaphthalene	0.024	0.02
SB-128	10-35	2-Methylnaphthalene	4	0.02
SB-128	10-35	Benzo(A)Anthracene	0.33	0.09
SB-128	10-35	Benzo(A)Pyrene	0.44	0.2
SB-128	10-35	Bis(2-Ethylhexyl) Phthalate	15	10
SB-128	10-35	Cis-1,2-Dichloroethene	1200	70

TABLE 3-9
Compounds Detected above Target Levels in Perimeter Groundwater Grab Samples
Hoover Perimeter Investigation

Station ID	Depth Interval	Compound	Lab Result (ug/L)	Target Level
SB-128	10-35	Dibenz(A,H)Anthracene	0.12	0.02
SB-128	10-35	Indeno(1,2,3-C,D)Pyrene	0.4	0.09
SB-128	10-35	Vinyl Chloride	270	2
SB-129	10-15	Cis-1,2-Dichloroethene	4900	70
SB-129	10-15	Vinyl Chloride	1400	2
SB-129	10-34	2-Methylnaphthalene	0.47	0.02
SB-129	10-34	Cis-1,2-Dichloroethene	2500	70
SB-129	10-34	Vinyl Chloride	550	2
SB-130	12-14	Dissolved Lead	25.2	15
SB-130	12-14	Dissolved Titanium	79.7	50
SB-131	18-21	2-Methylnaphthalene	0.25	0.02
SB-132	14-16	2-Methylnaphthalene	0.068	0.02
SB-132	14-16	Tetrachloroethene	15	5
SB-132	14-16	Trichloroethene	30	5
SB-132	25-27	2-Methylnaphthalene	0.57	0.02
SB-132	25-27	Benzo(A)Anthracene	0.11	0.09
SB-132	25-27	Benzo(B)Fluoranthene	0.17	0.09
SB-132	25-27	Cis-1,2-Dichloroethene	86	70
SB-132	25-27	Trichloroethene	32	5
SB-133	06-16	Cis-1,2-Dichloroethene	320	70
SB-133	06-16	Tetrachloroethene	190	5
SB-133	06-16	Trichloroethene	350	5
SB-133	22-24	2-Methylnaphthalene	0.23	0.02
SB-133	22-24	Bis(2-Ethylhexyl) Phthalate	21	10
SB-133	22-24	Cis-1,2-Dichloroethene	180	70
SB-133	22-24	Tetrachloroethene	21	5
SB-133	22-24	Trichloroethene	88	5
SB-134	06-16	2-Methylnaphthalene	0.023	0.02
SB-134	06-16	Cis-1,2-Dichloroethene	960	70
SB-134	06-16	Tetrachloroethene	760	5
SB-134	06-16	Trichloroethene	680	5
SB-135	10-20	Cis-1,2-Dichloroethene	410	70
SB-135	10-20	Dissolved Thallium	11.8	10
SB-135	10-20	Trichloroethene	340	5
SB-139	17-18	2-Methylnaphthalene	0.13	0.02
SB-140	10-12	2-Methylnaphthalene	0.053	0.02
SB-140	17-18	2-Methylnaphthalene	0.12	0.02
SB-141	06-08	2-Methylnaphthalene	10	0.02
SB-141	06-08	Naphthalene	10	6
SB-141	22-23	2-Methylnaphthalene	17	0.02
SB-141	22-23	Naphthalene	11	6
SB-143	21-22	2-Methylnaphthalene	2	0.02
SB-144	17-18	2-Methylnaphthalene	10	0.02
SB-144	17-18	Naphthalene	210	6
SB-144	17-18	Phenanthrene	57	10
SB-151	15-20	2-Methylnaphthalene	0.03	0.02
SB-154	01-11	Benzo(A)Anthracene	0.17	0.09
SB-154	01-11	Benzo(A)Pyrene	0.22	0.2
SB-154	01-11	Benzo(B)Fluoranthene	0.29	0.09
SB-154	01-11	Dibenz(A,H)Anthracene	0.027	0.02
SB-154	01-11	Indeno(1,2,3-C,D)Pyrene	0.19	0.09
SB-176	14-24	Bis(2-Ethylhexyl) Phthalate	16	10
SB-178	03-13	2-Methylnaphthalene	0.48	0.02

TABLE 3-10
Dissolved vs. Total Metals Concentrations in Groundwater Grab Samples
Hoover Perimeter Investigation

Station ID	Depth Interval	Compound	Dissolved Metals Concentration (ug/L)	Total Metals Concentration (ug/L)	Ratio (Total/Dissolved Metals)	Suspended Solids[1] (mg/L)
SB-108	14-16	Arsenic	26.7	74.7	2.8	26
SB-108	14-16	Barium	324	495	1.5	26
SB-108	14-16	Iron	13,600	172,000	12.6	26
SB-109	12-16	Barium	210	552	2.6	
SB-110	14-16	Zinc	21.1	96.7	4.6	
SB-114	18-20	Copper	55.9	793	14.2	
SB-114	18-20	Zinc	34	3,350	98.5	
SB-115	06-16	Managanese	207	2,750	13.3	
SB-115	18-20	Iron	1,140	421,000	369.3	
SB-115	18-20	Managanese	907	10,200	11.2	
SB-116	04-14	Iron	172	284,000	1651.2	4,000
SB-118	04-06	Zinc	27.9	6,120	219.4	
SB-118	20-22	Barium	318.0	3,370	10.6	
SB-118	20-22	Copper	146.0	1,240	8.5	
SB-118	20-22	Zinc	73.1	4,690	64.2	
SB-119	06-10	Barium	297.0	2,130	7.2	
SB-119	06-10	Zinc	22.7	2,510	110.6	
SB-119	16-18	Barium	471	1,840	3.9	
SB-119	16-18	Chromium, Total	19.7	73.6	3.7	
SB-119	16-18	Copper	74.8	75	1.0	
SB-119	16-18	Lead	12.3	87.9	7.1	
SB-119	16-18	Nickel	41.8	165	3.9	
SB-119	16-18	Titanium	75.6	135	1.8	
SB-119	16-18	Zinc	116	642	5.5	
SB-120	10-22	Barium	519	1,530	2.9	27,000
SB-120	10-22	Iron	10,900	73,400	6.7	27,000
SB-121	10-18	Iron	142	145,000	1021.1	
SB-121	10-18	Managanese	1,240	2,550	2.1	
SB-122	08-25	Zinc	23.8	800	33.6	
SB-123	20-22	Barium	207	5,180	25.0	
SB-123	20-22	Iron	621	1,920,000	3091.8	
SB-123	20-22	Managanese	16,100	147,000	9.1	
SB-123	20-22	Nickel	65.2	1,860	28.5	
SB-123	20-22	Zinc	32.3	5,720	177.1	
SB-124	32-33	Barium	441	5,260	11.9	
SB-124	32-33	Lead	3.8	919	241.8	
SB-124	32-33	Nickel	90.2	1,720	19.1	
SB-124	32-33	Zinc	506	4,940	9.8	
SB-125	08-10	Barium	301	5,910	19.6	92,000
SB-125	08-10	Cadmium	436	262	0.6	92,000
SB-125	08-10	Chromium, Total	12.4	338	27.3	92,000
SB-125	08-10	Copper	25	1,280	51.2	92,000
SB-125	08-10	Iron	6,560	1,310,000	199.7	92,000
SB-125	08-10	Nickel	1,300	1,640	1.3	92,000
SB-125	08-10	Titanium	103	1,210	11.7	92,000
SB-126	06-08	Iron	120	20,500	170.8	
SB-126	06-08	Managanese	115	767	6.7	
SB-126	38-40	Barium	288	1,860	6.5	
SB-126	38-40	Iron	301	3,620,000	12026.6	
SB-126	38-40	Managanese	1,370	58,100	42.4	

TABLE 3-10
Dissolved vs. Total Metals Concentrations in Groundwater Grab Samples
Hoover Perimeter Investigation

Station ID	Depth Interval	Compound	Dissolved Metals Concentration (ug/L)	Total Metals Concentration (ug/L)	Ratio (Total/Dissolved Metals)	Suspended Solids[1] (mg/L)
SB-127	06-08	Barium	211	4,260	20.2	
SB-127	06-08	Copper	73	395	5.4	
SB-127	06-08	Iron	530	714,000	1347.2	
SB-127	35-37	Barium	368	2,390	6.5	
SB-127	35-37	Iron	1,210	1,450,000	1198.3	
SB-127	35-37	Managanese	1,240	28,200	22.7	
SB-128	08-10	Lead	9.8	1,350	137.8	
SB-128	10-12	Arsenic	17	25	1.5	
SB-128	10-35	Arsenic	20.4	1,640	80.4	
SB-128	10-35	Barium	308	4,260	13.8	
SB-128	10-35	Lead	3	2,490	830.0	
SB-129	10-15	Barium	280	571	2.0	
SB-129	10-34	Barium	214	1,480	6.9	
SB-129	10-34	Iron	18,700	592,000	31.7	
SB-129	10-34	Managanese	865	12,600	14.6	
SB-129	10-34	Zinc	142	8,780.0	61.8	
SB-130	12-14	Chromium, Total	12.7	13.8	1.1	1,100
SB-130	12-14	Copper	59.8	130	2.2	1,100
SB-130	12-14	Iron	32,000	32,300	1.0	1,100
SB-130	12-14	Lead	25.2	41.9	1.7	1,100
SB-130	12-14	Titanium	79.7	158	2.0	1,100
SB-130	26-28	Iron	2,380	114,000	47.9	7,800
SB-131	18-21	Nickel	88	802	9.1	
SB-132	14-16	Managanese	2,380	1,530	0.6	
SB-133	22-24	Barium	302	1,090	3.6	
SB-133	22-24	Copper	102	201	2.0	
SB-139	17-18	Managanese	420	827	2.0	
SB-140	17-18	Zinc	26.3	580	22.1	
SB-176	14-24	Zinc	20.2	21.6	1.1	79

Notes
1 Suspended Solids data was only available for stations where treatability parameters were measured.

TABLE 3-11
Compounds Detected in Perimeter Groundwater Monitoring Wells
Hoover Perimeter Investigation

Compound	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Detection (µg/l)	Minimum Detection (µg/l)	Mean (µg/l)	Target Level (µg/l)	Number of Detections > Target Level
1,1,1,2-Tetrachloroethane	11	0	0%				1	0
1,1,1-Trichloroethane	11	0	0%				200	0
1,1,2,2-Tetrachloroethane	11	0	0%				1	0
1,1,2-Trichloroethane	11	0	0%				5	0
1,1-Dichloroethene	11	0	0%				7	0
1,2,3-Trichloropropane	11	0	0%				1	0
1,2,4,5-Tetrachlorobenzene	11	0	0%				10.00	0
1,2,4-Trichlorobenzene	11	0	0%				70	0
1,2-Dibromo-3-Chloropropane	11	0	0%				2	0
1,2-Dibromoethane	11	0	0%				1	0
1,2-Dichlorobenzene	11	0	0%				600	0
1,2-Dichloroethane	11	0	0%				5	0
1,2-Dichloropropane	11	0	0%				5	0
1,3,5-Trinitrobenzene	11	0	0%				1,000	0
1,3-Dichlorobenzene	11	0	0%				20	0
1,3-Dinitrobenzene	11	0	0%				10	0
1,4-Dichlorobenzene	11	0	0%				80	0
1,4-Dioxane	11	0	0%				200	0
1,4-Naphthoquinone	11	0	0%				50	0
1-Naphthylamine	11	0	0%				10	0
2,3,4,6-Tetrachlorophenol	11	0	0%				1,000	0
2,4,5-T (Trichlorophenoxyacetic Acid)	11	0	0%				400	0
2,4,5-Trichlorophenol	11	0	0%				4,000	0
2,4,6-Trichlorophenol	11	0	0%				10	0
2,4-D (Dichlorophenoxyacetic Acid)	11	0	0%				70	0
2,4-Dichlorophenol	11	0	0%				100	0
2,4-Dimethylphenol	11	0	0%				730	0
2,4-Dinitrophenol	11	0	0%				70	0
2,4-Dinitrotoluene	11	0	0%				70	0
2,6-Dichlorophenol	11	0	0%				10	0
2,6-Dinitrotoluene	11	0	0%				40	0
2-Acetylaminofluorene	11	0	0%				100	0
2-Aminonaphthalene (Beta Naphthylamine)	11	0	0%				10	0
2-Butanone	11	0	0%				2,000	0
2-Chloro-1,3-Butadiene	11	0	0%				10	0
2-Chloronaphthalene	11	0	0%				500	0
2-Chlorophenol	11	0	0%				40	0
2-Hexanone	11	0	0%				10	0
2-Methylnaphthalene	22	3	14%	0.042	0.026	0.033	0.02	3
2-Methylphenol (O-Cresol)	11	0	0%				2,000	0
2-Nitroaniline	11	0	0%				50	0
2-Nitrophenol	11	0	0%				10	0
2-Picoline (Alpha-Picoline)	11	0	0%				20	0
3,3'-Dichlorobenzidine	11	0	0%				50	0
3,3'-Dimethylbenzidine	11	0	0%				50	0
3-Methylcholanthrene	22	0	0%				0.5	0
3-Methylphenol	11	0	0%				2,000	0
3-Nitroaniline	11	0	0%				50	0
4,6-Dinitro-2-Methylphenol	11	0	0%				50	0
4-Aminobiphenyl (4-Biphenylamine)	11	0	0%				50	0
4-Bromophenyl Phenyl Ether	11	0	0%				10	0
4-Chloro-3-Methylphenol	11	0	0%				10	0
4-Chloroaniline	11	0	0%				100	0
4-Chlorophenyl Phenyl Ether	11	0	0%				10	0
4-Methyl-2-Pentanone	11	0	0%				200	0
4-Methylphenol (P-Cresol)	11	0	0%				200	0
4-Nitroaniline	11	0	0%				50	0
4-Nitrophenol	11	0	0%				2,000	0
4-Nitroquinoline-N-Oxide	11	0	0%				100	0
5-Nitro-O-Toluidine	11	0	0%				20	0
7,12-Dimethylbenz(A)Anthracene	22	0	0%				0.5	0
Acenaphthene	11	0	0%				400	0
Acenaphthylene	11	0	0%				10	0
Acetone	11	0	0%				600	0
Acetonitrile	11	0	0%				70	0
Acetophenone	11	0	0%				10	0
Acrolein	11	0	0%				20	0
Acrylonitrile	11	0	0%				20	0
Aldrin	11	0	0%				0.05	0
Allyl Chloride	11	0	0%				2,000	0
Alpha BHC (Alpha Hexachlorocyclohexane)	11	0	0%				0.05	0
Alpha Endosulfan	11	0	0%				0.05	0
Aniline (Phenylamine, Aminobenzene)	11	0	0%				10	0
Anthracene	11	0	0%				2,000	0
Dissloved Antimony	11	0	0%				60	0
Total Antimony	11	0	0%				60	0
Aramite	11	0	0%				20	0
Dissolved Arsenic	11	1	9%	10.8	10.8	10.8	50	0
Total Arsenic	11	2	18%	14	10.2	12.1	50	0
Dissolved Barium	11	3	27%	412	238	318.3	2,000	0
Total Barium	11	3	27%	437	269	339.3	2,000	0
Benzene	11	0	0%				5	0
Benzo(A)Anthracene	22	0	0%				0.09	0
Benzo(A)Pyrene	22	0	0%				0.2	0

TABLE 3-11
Compounds Detected in Perimeter Groundwater Monitoring Wells
Hoover Perimeter Investigation

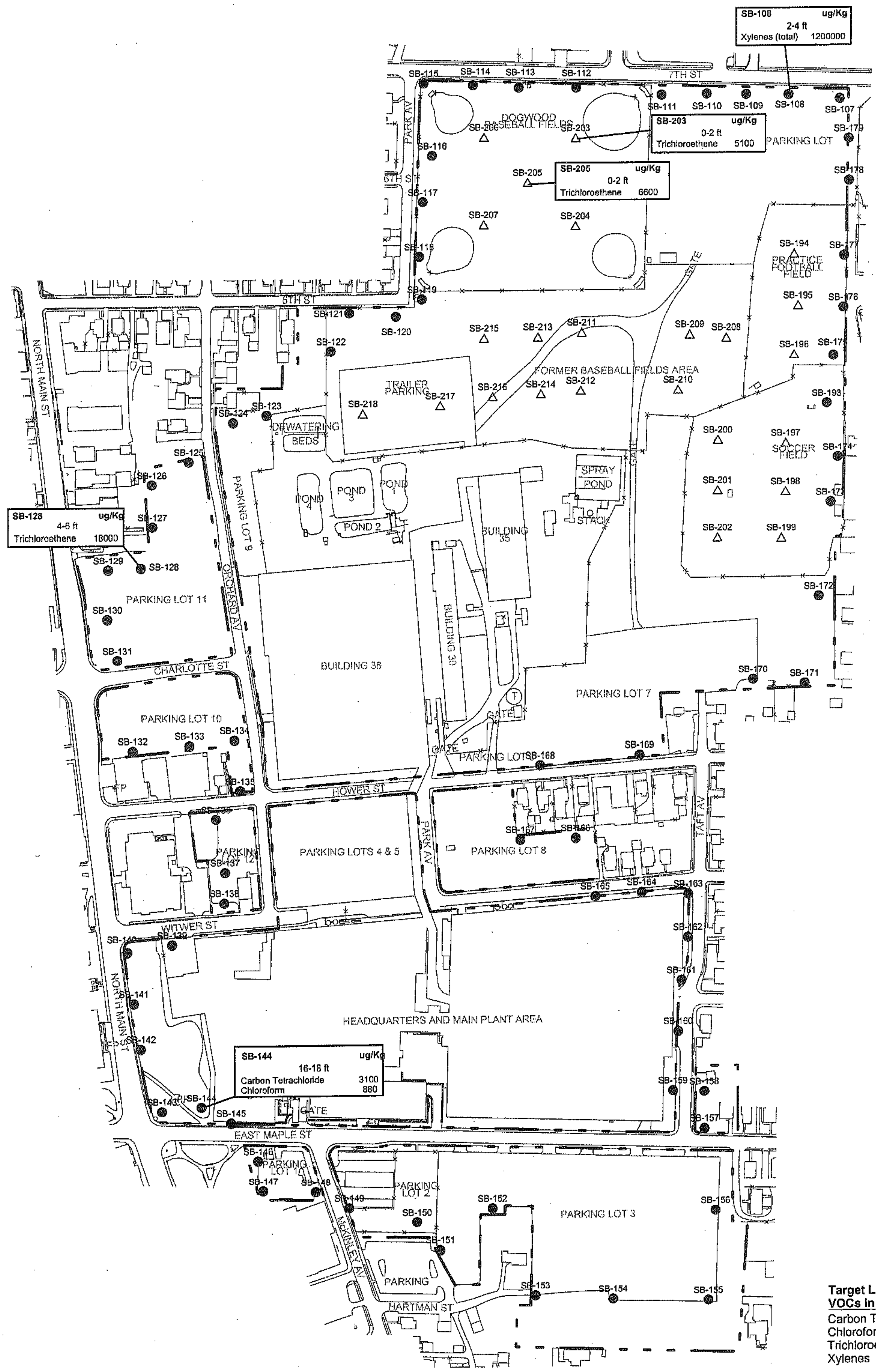
Compound	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Detection (µg/l)	Minimum Detection (µg/l)	Mean (µg/l)	Target Level (µg/l)	Number of Detections > Target Level
Benzo(B)Fluoranthene	22	0	0%				0.09	0
Benzo(G,H,I)Perylene	22	0	0%				10	0
Benzo(K)Fluoranthene	22	0	0%				0.9	0
Benzyl Alcohol	11	0	0%				11,000	0
Benzyl Butyl Phthalate	11	0	0%				7,000	0
Dissolved Beryllium	11	0	0%				5	0
Total Beryllium	11	0	0%				5	0
Beta BHC (Beta Hexachlorocyclohexane)	11	0	0%				0.05	0
Beta Endosulfan	11	0	0%				0.05	0
Bis(2-Chloroethoxy) Methane	11	0	0%				10	0
Bis(2-Chloroethyl) Ether (2-Chloroethyl Eth	11	0	0%				10	0
Bis(2-Chloroisopropyl) Ether	11	0	0%				10	0
Bis(2-Ethylhexyl) Phthalate	11	1	9%	13	13	13	10	1
Bromodichloromethane	11	0	0%				100	0
Bromoform	11	0	0%				100	0
Bromomethane	11	0	0%				9	0
Dissolved Cadmium	11	1	9%	10.6	10.6	10.6	5	1
total Cadmium	11	1	9%	10.3	10.3	10.3	5	1
Carbon Disulfide	11	0	0%				1,000	0
Carbon Tetrachloride	11	0	0%				5	0
Chlordane	11	0	0%				2	0
Chlorobenzene	11	0	0%				40	0
Chlorobenzilate	11	0	0%				10	0
Chloroethane	11	0	0%				9,000	0
Chloroform	11	0	0%				100	0
Chloromethane	11	0	0%				2	0
Chrysene	22	0	0%				9	0
cis-1,2-Dichloroethene	11	4	36%	19000	0.73	4755	70	1
cis-1,3-Dichloropropene	11	0	0%				1	0
Dissolved Cobalt	11	0	0%				2,000	0
Total Cobalt	11	0	0%				2,000	0
Dissolved Copper	11	0	0%				1,000	0
Total Copper	11	1	9%	49.3	49.3	49.3	1,000	0
Cyanide	11	2	18%	0.012	0.01	0.011	200	0
Delta BHC (Delta Hexachlorocyclohexane)	11	0	0%				0.05	0
Di-N-Butyl Phthalate	11	0	0%				4,000	0
Di-N-Octylphthalate	11	0	0%				700	0
Diallate	11	0	0%				20	0
Dibenz(A,H)Anthracene	22	0	0%				0.02	0
Dibenzofuran	11	0	0%				20	0
Dibromochloromethane	11	0	0%				1	0
Dibromomethane	11	0	0%				400	0
Dichlorodifluoromethane	11	0	0%				400	0
Dieldrin	11	0	0%				0.05	0
Diethyl Phthalate	11	0	0%				29,000	0
Dimethoate	11	0	0%				20	0
Dimethyl Phthalate	11	0	0%				365,000	0
Dinoseb	11	0	0%				20	0
Diphenylamine	11	0	0%				900	0
Disulfoton	9	0	0%				50	0
Endosulfan Sulfate	11	0	0%				0.05	0
Endrin	11	0	0%				2	0
Endrin Aldehyde	11	0	0%				0.05	0
Ethyl Methacrylate	11	0	0%				500	0
Ethyl Methanesulfonate	11	0	0%				10	0
Ethylbenzene	11	0	0%				700	0
Famphur	9	0	0%				1	0
Fluoranthene	11	0	0%				1,000	0
Fluorene	11	0	0%				200	0
Gamma BHC (Lindane)	11	0	0%				0.05	0
Heptachlor	11	0	0%				0.4	0
Heptachlor Epoxide	11	0	0%				0.2	0
Hexachlorobenzene	11	0	0%				10	0
Hexachlorobutadiene	11	0	0%				10	0
Hexachlorocyclopentadiene	11	0	0%				50	0
Hexachloroethane	11	0	0%				10	0
Hexachloropropene	11	0	0%				100	0
Indeno(1,2,3-C,D)Pyrene	22	0	0%				0.09	0
Iodomethane	22	0	0%				1	0
Isodrin	11	0	0%				0.1	0
Isophorone	11	0	0%				70	0
Isosafrole	11	0	0%				20	0
Kepone	11	0	0%				1	0
Dissolved Lead	11	1	9%	4.1	4.1	4.1	15	0
Total Lead	11	2	18%	12.9	4	8.45	15	0
Dissolved Mercury	11	0	0%				2	0
Total Mercury	11	0	0%				2	0
Methacrylonitrile	11	0	0%				1	0
Methapyrilene	11	0	0%				50	0
Methoxychlor	11	0	0%				40	0
Methyl Methacrylate	11	0	0%				1,000	0
Methyl Methanesulfonate	11	0	0%				10	0
Methylene Chloride	11	0	0%				4	0
MPEA11	11	0	0%				50	0

TABLE 3-11
Compounds Detected in Perimeter Groundwater Monitoring Wells
Hoover Perimeter Investigation

Compound	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Detection (µg/l)	Minimum Detection (µg/l)	Mean (µg/l)	Target Level (µg/l)	Number of Detections > Target Level
N-Nitroso-Di-N-Butylamine	11	0	0%				10	0
N-Nitrosodi-N-Propylamine	11	0	0%				10	0
N-Nitrosodiethylamine	11	0	0%				10	0
N-Nitrosodiphenylamine	11	0	0%				10	0
N-Nitrosomorpholine	11	0	0%				10	0
N-Nitrosopyrrolidine	11	0	0%				10	0
Naphthalene	22	3	14%	0.025	0.02	0.023	6	0
Dissolved Nickel	11	4	36%	71.7	52.3	59.6	100	0
Total Nickel	11	4	36%	134	52	85.6	100	1
Nitrobenzene	11	0	0%				10	0
Nitrosomethylethylamine	11	0	0%				10	0
O,O,O-Triethyl Phosphorothioate	9	0	0%				1	0
O-Toluidine	11	0	0%				20	0
P,P'-Ddd	11	0	0%				0.3	0
P,P'-Dde	11	0	0%				0.2	0
P,P'-Ddt	11	0	0%				0.2	0
P-Dimethylaminoazobenzene	11	0	0%				20	0
P-Phenylenediamine	11	0	0%				7,000	0
Parathion, Ethyl	9	0	0%				219	0
Parathion, Methyl	9	0	0%				9.1	0
Pcb-1016 (Arochlor 1016)	11	0	0%				1	0
Pcb-1221 (Arochlor 1221)	11	0	0%				1	0
Pcb-1232 (Arochlor 1232)	11	0	0%				1	0
Pcb-1242 (Arochlor 1242)	11	0	0%				1	0
Pcb-1248 (Arochlor 1248)	11	0	0%				1	0
Pcb-1254 (Arochlor 1254)	11	0	0%				1	0
Pcb-1260 (Arochlor 1260)	11	0	0%				1	0
Pentachlorobenzene	11	0	0%				30	0
Pentachloroethane	11	0	0%				50	0
Pentachloronitrobenzene	11	0	0%				50	0
Pentachlorophenol	11	0	0%				10	0
Phenacetin	11	0	0%				20	0
Phenanthrene	11	0	0%				10	0
Phenol	11	0	0%				22,000	0
Phorate	9	0	0%				7.3	0
Pronamide	11	0	0%				3,000	0
Propionitrile	11	0	0%				4	0
Pyrene	11	0	0%				200	0
Pyridine	11	0	0%				40	0
Safrole	11	0	0%				20	0
Dissolved Selenium	11	1	9%	6	6	6	50	0
Total Selenium	11	0	0%				50	0
Dissolved Silver	11	0	0%				200	0
Total Silver	11	0	0%				200	0
Silvex (2,4,5-Tp)	11	0	0%				300	0
Styrene	11	0	0%				100	0
Tetrachlorinated Dibenzo-P-Dioxins, (Total)	7	0	0%				0.0007	0
Tetrachloroethene	11	1	9%	77	77	77	5	1
Dissolved Thallium	11	0	0%				10	0
Total Thallium	11	0	0%				10	0
Thiodiphosphoric Acid Tetraethyl Ester	9	0	0%				18.25	0
Dissolved Tin	11	0	0%				100	0
Total Tin	11	0	0%				100	0
Dissolved Titanium	11	0	0%				50	0
Total Titanium	11	1	9%	168	168	168	50	1
Toluene	11	0	0%				1,000	0
Toxaphene	11	0	0%				3	0
trans-1,2-Dichloroethene	11	0	0%				100	0
trans-1,3-Dichloropropene	11	0	0%				1	0
trans-1,4-Dichloro-2-Butene	11	0	0%				1	0
Trichloroethene	11	1	9%	21	21	21	5	1
Trichlorofluoromethane	11	0	0%				1,000	0
Vinyl Acetate	11	0	0%				255.5	0
Vinyl Acetate	11	0	0%				400	0
Vinyl Chloride	11	2	18%	5100	2	2551	2	2
Xylenes, Total	11	0	0%				10,000	0
Dissolved Zinc	11	1	9%	51.5	51.5	51.5	5,000	0
Total Zinc	11	4	36%	100	21.8	49.1	5,000	0
Total	2721	47						13

TABLE 3-12
Compounds Detected above Target Levels in Perimeter Groundwater Monitoring Wells Samples
Hoover Perimeter Investigation

Station ID	Depth Interval	Compound	Lab Result (μg/L)	Target Level
MW-13S	06-16	Vinyl Chloride	2	2
MW-15D	34-44	2-Methylnaphthalene	0.042	0.02
MW-15D	34-44	Total Nickel	134	100
MW-17S	05-15	Tetrachloroethene	77	5
MW-17S	05-15	Trichloroethene	21	5
MW-17S	05-15	Total Cadmium	10.3	5
MW-17S	05-15	Dissolved Cadmium	10.6	5
MW-18S	14-24	2-Methylnaphthalene	0.026	0.02
MW-18S	14-24	cis-1,2-Dichloroethene	19000	70
MW-18S	14-24	Vinyl Chloride	5100	2
MW-21D	44-54	2-Methylnaphthalene	0.032	0.02
MW-21S	09-19	Total Titanium	168	50
MW-22D	36-46	Bis(2-Ethylhexyl) Phthalate	13	10



Target Levels

VOCs in Soil	ug/kg
Carbon Tetrachloride	523.5
Chloroform	300
Trichloroethene	5000
Xylenes	410,000

North

0 150 300 450 600
Feet

LEGEND

- ● Soil and groundwater sampling location
- △ Shallow soil only (0'-2') sampling location
- Approximate property boundary
- SB-203 ug/kg, 15-20 ft, Vinyl Chloride 0.03 — Boring ID, units, sample depth, parameter and analytical result

NOTES

1. Base map derived from orthographic aerial photos taken January 17, 2000.
2. All samples were collected November 1999 through January 2000.

(DAY) //Antigone/hoover/surffigs/Fig3_1VOC_Soil.srf (boring_bd.dat) 05/04/00

FIGURE 3-1

Volatile Organic Compounds Detected above Target Levels at Perimeter Borings in Soil

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The Hoover Company, North Canton, Ohio

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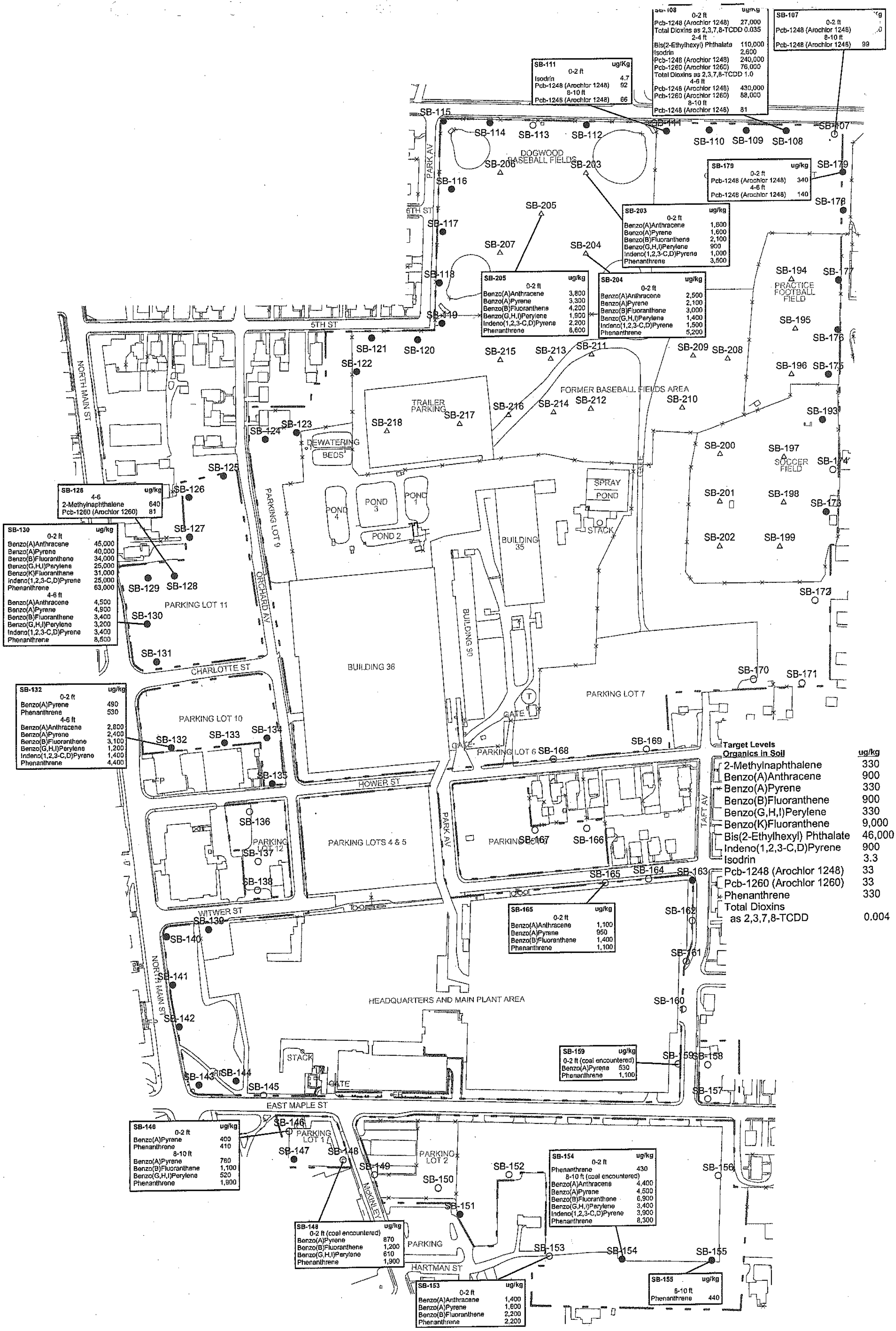

North

0 75 150 225 300
FEET

LEGEND

- ● Soil and groundwater sampling location
- ○ Borings where groundwater was not sufficient to take a sample
- △ Shallow soil only (0'-2') sampling location
- — — Approximate property boundary

SB-203	ug/l
15-20 ft	
Vinyl Chloride	0.03

Boring ID, units, sample depth, parameter and analytical result

NOTES

1. Base map derived from orthographic aerial photos taken January 17, 2000.
2. All samples were collected November 1999 through January 2000.

DAY1/j:/hoover/surffigs/Fig3_2OrgSoil_Ldgr.srf (boring_bd2.dat) 05/04/00

FIGURE 3-2

Semi-Volatile Organic Compounds, Pesticides and PCBs Detected Above Target Levels at Perimeter Borings in Soil

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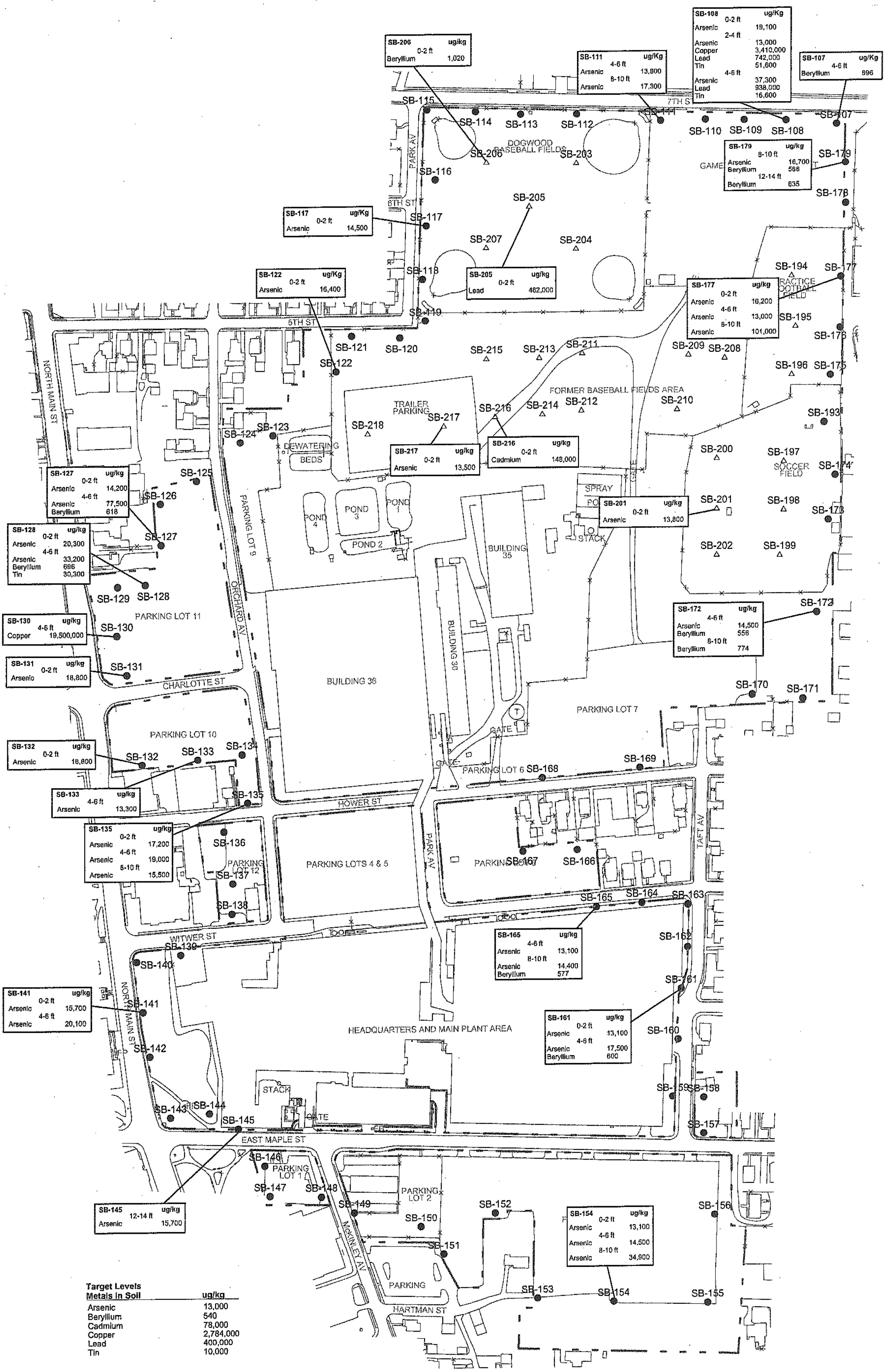

Target Levels Metals in Soil	ug/kg
Arsenic	13,000
Beryllium	540
Cadmium	78,000
Copper	2,784,000
Lead	400,000
Tin	10,000

LEGEND

- ● Soil sampling location
- △ Shallow soil only (0'-2') sampling location
- — — Approximate property boundary
- SB-205 ug/kg 0-2 ft Arsenic 0.03 — Boring ID, units, sample depth, parameter and analytical result

NOTES

1. Base map derived from orthographic aerial photos taken January 17, 2000.
2. All samples were collected November 1999 through January 2000.

DAY1/j:/hoover/surffigs/Fig3_3MetalsInSoil.srf (boring_bd2.dat) 05/04/00

FIGURE 3-3
Metals Detected Above Target Levels at Perimeter Borings in Soil
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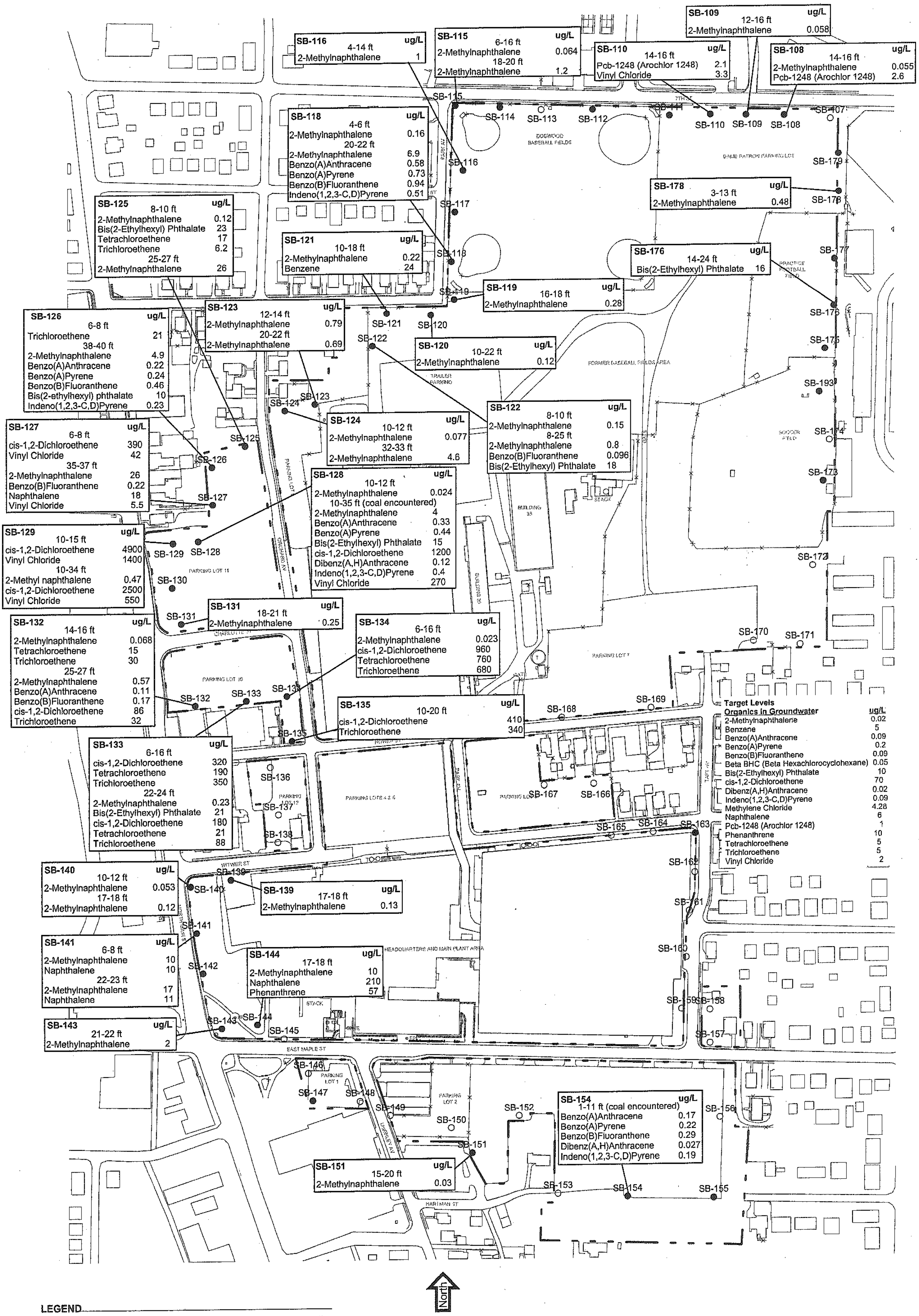

LEGEND

- ● Soil and groundwater sampling location
- ○ Borings where groundwater was not sufficient to take a sample
- Approximate property boundary

SB-203	ug/L
15-20 ft	
Vinyl Chloride	0.03

Boring ID, units, sample depth, parameter and analytical result

NOTES

1. Base map derived from orthographic aerial photos taken January 17, 2000.
2. All samples were collected November 1999 through January 2000.

Antigone(j:)/hoover/surffigs/Fig3_4PerimNonMetals_Ldgr.srf (boring_bd2.dst) 05/04/00

FIGURE 3-4

Organic Compounds Detected Above Target Levels at Perimeter Borings in Groundwater

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The Hoover Company, North Canton, Ohio

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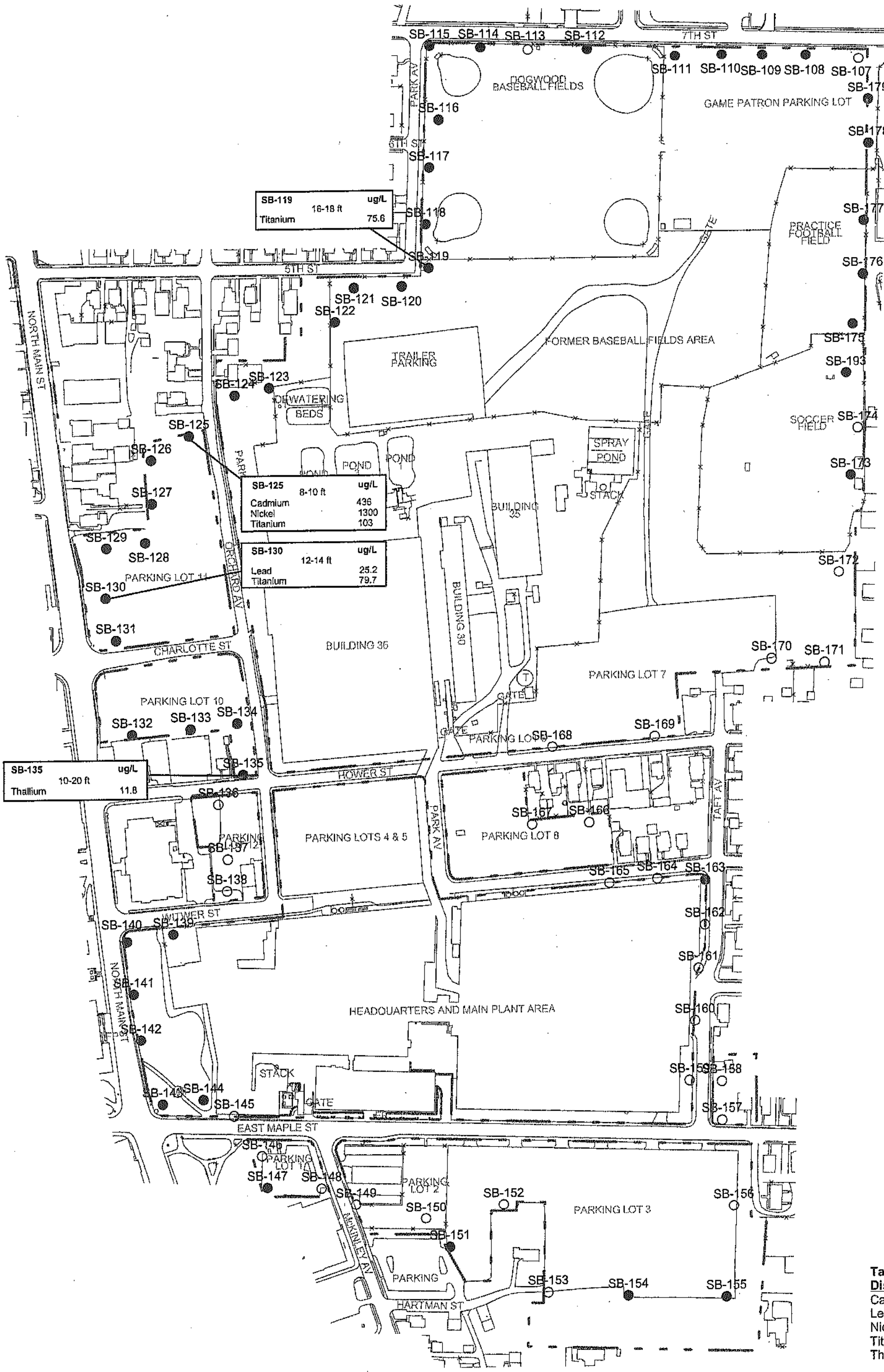

Target Levels Dissolved Metals	ug/L
Cadmium	5
Lead	15
Nickel	100
Titanium	50
Thallium	10

North

0 150 300 450 600
Feet

LEGEND

- ● Soil and groundwater sampling location
- ○ Borings where groundwater was not sufficient to take a sample
- ▬ ▪ Approximate property boundary
- SB-203 ug/L 15-20 ft Vinyl Chloride 0.03 — Boring ID, units, sample depth, parameter and analytical result

NOTES

1. Base map derived from orthographic aerial photos taken January 17, 2000.
2. All samples were collected November 1999 through January 2000.

FIGURE 3-5

Dissolved Metal Detections Above Target Levels at Perimeter Borings in Groundwater

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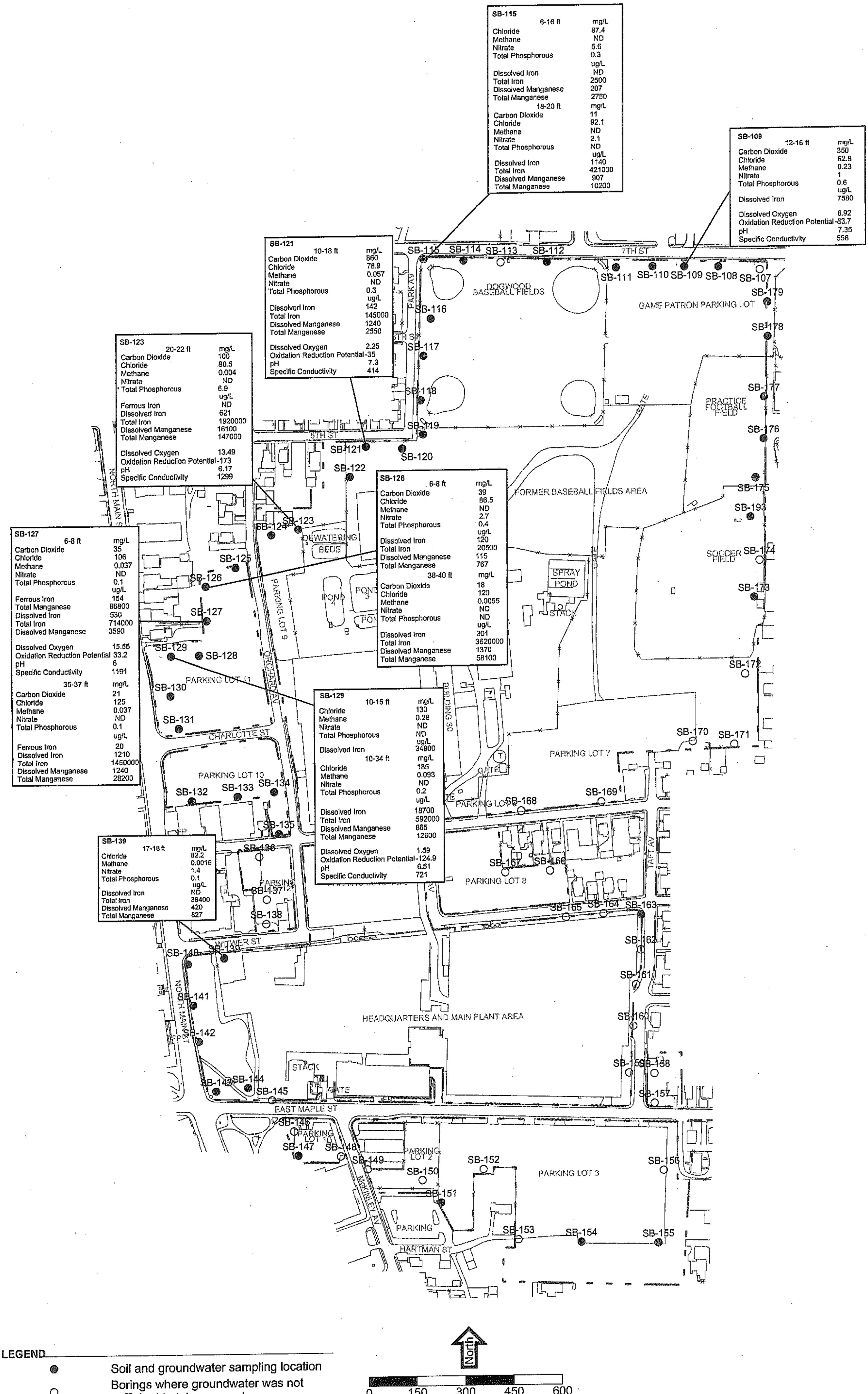
(DAY) //Antigone/hoover/surffigs/Fig3_5Dissolved_Metals.srf (boring_bd.dat) 05/04/00



LEGEND

- ● Soil and groundwater sampling location
- ○ Borings where groundwater was not sufficient to take a sample
- — Approximate property boundary
- SB-203 mg/L / 15-20 ft / Vinyl Chloride 0.03 — Boring ID, units, sample depth, parameter and analytical result
- ND — Nondetected

FIGURE 3-6
General Chemistry Parameters at Perimeter Borings in Groundwater
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The Hoover Company, North Canton, Ohio
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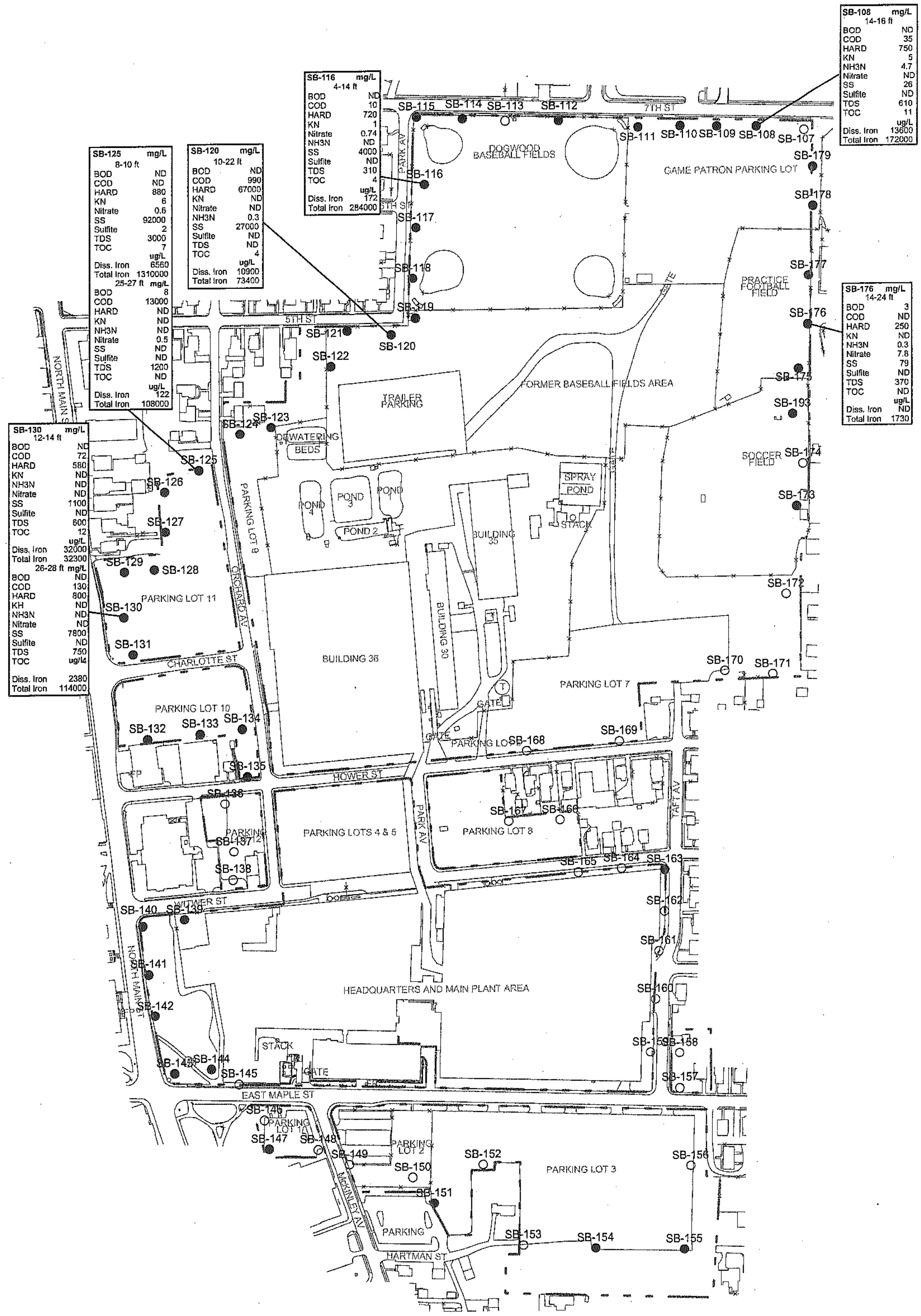
NOTES
1. Base map derived from orthographic aerial photos taken January 17, 2000.
2. All samples were collected November 1999 through January 2000.

(DAY) //Antigone/hoover/surffigs/Fig3_6GenChem_Data.srf (boring_bd.dat) 05/04/00



LEGEND

- ● Soil and groundwater sampling location
- ○ Borings where groundwater was not sufficient to take a sample
- ▬ ▪ Approximate property boundary

SB-203	mg/L
15-20 ft	
Vinyl Chloride	0.03

Boring ID, units, sample depth, parameter and analytical result

North

0 150 300 450 600
Feet

NOTES

1. Base map derived from orthographic aerial photos taken January 17, 2000.
2. All samples were collected November 1999 through January 2000.
3. BOD Biologic Oxygen Demand, Five Day
   COD Chemical Oxygen Demand
   HARD Hardness (As Caco3)
   NH3N Nitrogen, Ammonia (As N)
   KN Nitrogen, Kjeldahl, Total
   SS Suspended Solids (Residue, Non-Filterable)
   TDS Total Dissolved Solids (Residue, Filterable)
   TOC Total Organic Carbon

FIGURE 3-7
Treatability Parameters at Perimeter Borings in Groundwater
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The Hoover Company, North Canton, Ohio

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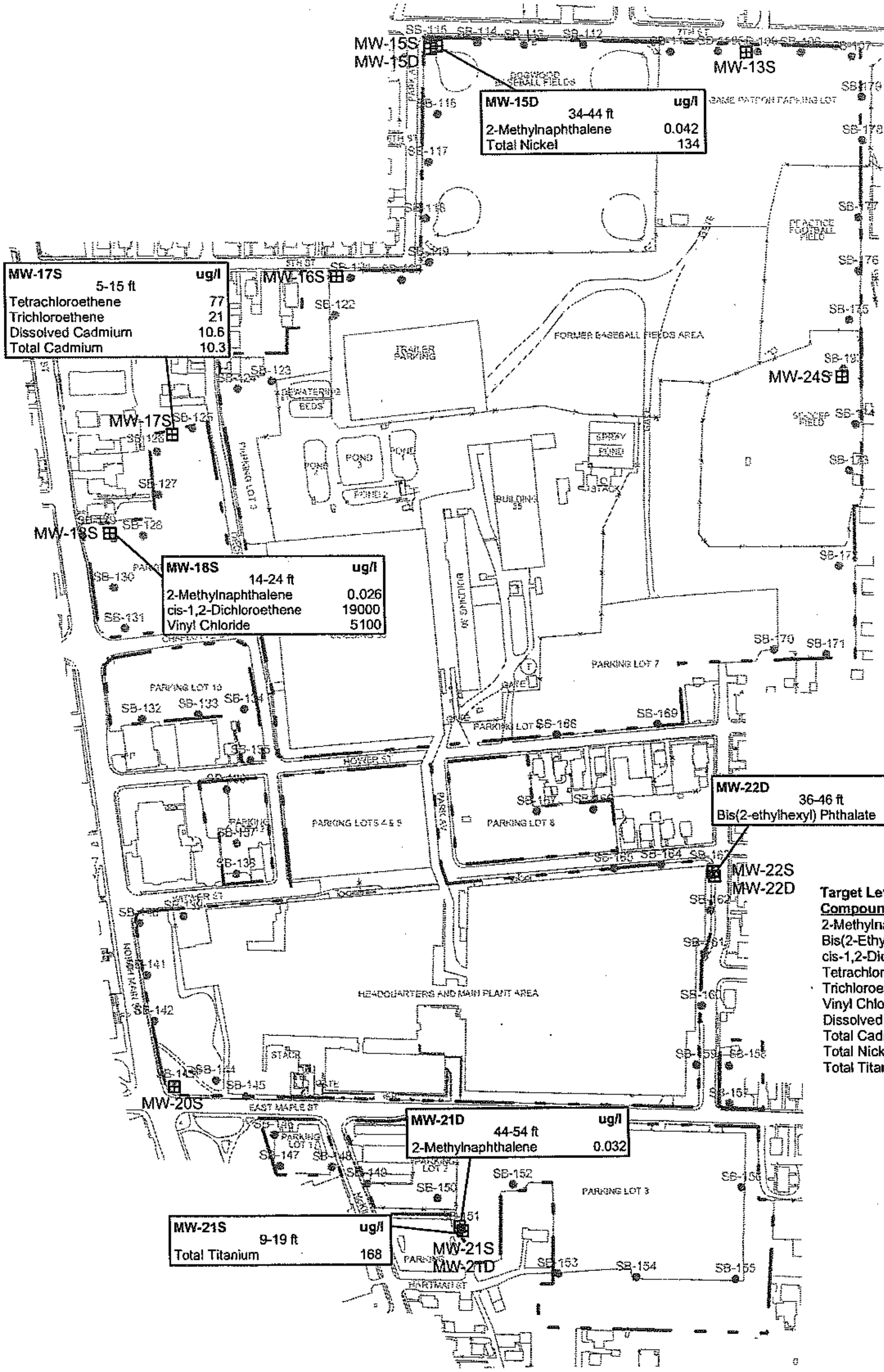
(DAY) //Antigone/hoover/surffigs/Fig3_7Treat_Param.srf (boring_bd.dat) 05/04/00



Target Levels

Compounds in Groundwater	ug/L
2-Methylnaphthalene	0.02
Bis(2-Ethylhexyl) Phthalate	10
cis-1,2-Dichloroethene	70
Tetrachloroethene	5
Trichloroethene	5
Vinyl Chloride	2
Dissolved Cadmium	5
Total Cadmium	5
Total Nickel	100
Total Titanium	50

LEGEND

MW-21S ⊞ — Monitoring well (MW) location. "S" indicates shallow screened depth (in unconsolidated deposits); "D" indicates deep screened depth (in bedrock).

SB-129 ● — Perimeter investigation boring location (SB)

Approximate property boundary

MW-18S	ug/l
14-24 ft	
Vinyl Chloride	5100

Well ID, units, sample depth, parameter and analytical result

NOTES

1. Base map derived from orthographic aerial photos taken January 17, 2000.
2. All samples were collected January 2000.

DAY1/j:/hoover/Fig3_8MWresults.srf (boring_gw2.dat) 05/04/00

FIGURE 3-8

Compounds Detected Above Target Levels in Groundwater at Perimeter Monitoring Wells

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The Hoover Company, North Canton, Ohio

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SECTION 4

Summary

The objectives for the Perimeter Investigation were designed to provide a starting point for Hoover's facility-wide RCRA Corrective Action investigations and evaluation. The Investigation results (summarized below with respect to the objectives) demonstrate how the objectives were achieved:

- *Objective: Identify whether site-related chemicals were present at the facility boundary, and if present, determine the chemical concentration distribution.*
  - The Perimeter Investigation Target Analyte List was developed to be representative of site-related chemicals (those chemicals known or suspected to potentially have been associated with Hoover operations). Sampling and analytical results showed that of all the analytical records generated, only between 1 and 4 percent of the analyses were at concentrations above Target Levels established and accepted by U.S. EPA as protective of human health. Of this small percentage of concentrations above Target Levels, the majority (about 81 percent) of the compounds were from the Perimeter Investigation Target Analyte List. Compounds that were detected at concentrations above Target levels that were not on the Target Analyte List (2-methylnaphthalene, isodrin, PCB-1248, PCB-1260, total dioxins, arsenic, beryllium, tin and thallium) are not known to be related to Hoover manufacturing processes. Other compounds that were detected at concentrations above Target Levels (such as the SVOCs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, indeno(1,2,3-c,d)pyrene, and phenanthrene) may also be derived from other sources such as automobile exhaust or asphalt. Further evaluation of these potentially "non-site-related" detections is currently underway (to evaluate if- for example- some of these detections may be derived from other sources, are within the range of background concentrations in the area, etc.).
  - The chemical concentration distribution has been identified along the perimeter, and on the surface of the publicly accessible recreational areas in the northerly portion of the facility within the facility boundaries.
- *Objective: Provide data that would allow an assessment of the potential chemical migration and support an analysis of potential risks to human health and the environment from chemicals identified at the facility boundary.*
  - The Perimeter Investigation obtained information on subsurface conditions (geology and hydrogeology) and observed water level data to develop a picture of groundwater flow patterns. These data, combined with data on groundwater quality, were used to assess the potential for chemicals to migrate in groundwater, and identify whether chemicals in groundwater may be migrating to the west or northwest from the facility.

- Similarly, information on ground surface conditions and cover materials is being evaluated along with the analytical results of surface soil samples to determine the potential for chemicals, present in the unsaturated zone at concentrations greater than Target Levels, to migrate either in vapor form or via leaching by surface water infiltration. At some locations chemicals that were detected above Target Levels in the 0-to-2 foot interval were located under some type of cover material that is generally considered to be a relatively impermeable cap, such as asphalt. The presence of this surface cover material not only prevents direct contact with the materials below, but may also significantly reduce the possibility of vapor or leaching migration for those chemicals.

- Information obtained to date has been sufficient to support preliminary analysis of potential risks to human health and the environment, as demonstrated by the "Preliminary Risk Evaluation – Recreational Areas at Hoover Plant 1, North Canton, OH" (Appendix A). This preliminary risk evaluation was conducted to assess the potential for risk associated with the detection of chemicals at concentrations above Target Levels in surface soil samples from publicly accessible recreational areas.

- *Objective: Identify and prioritize areas where additional onsite or offsite characterization is warranted to determine whether migration has occurred.*

  - Based on the results of the Perimeter Investigation indicating areas where chemicals were detected at concentrations exceeding Target Levels, the following areas have been identified for additional investigation:

    - The Dogwood Baseball fields, where the preliminary risk evaluation (Appendix A) indicated that additional information was needed, but that potential exposures there and in other recreational areas did not pose an unacceptable risk (as defined by USEPA 1991 and 1996) to recreational users. As a result of this, additional soil and groundwater sampling was completed in the Dogwood Baseball Fields area. This additional investigation effort is documented in "The Hoover Company Dogwood Baseball Fields Additional Investigation" and "Dogwood Baseball Fields Subsurface Investigation"(Appendix B) and "Addendum to the Preliminary Risk Evaluation – Recreational Areas at Hoover Plant 1, North Canton, OH"(Appendix C).

    - Groundwater offsite to the west of the facility, which is in the predominant direction of the groundwater flow gradient, and was identified based on the numbers and concentrations of chemicals present in groundwater at concentrations above Target Levels along the west-central perimeter. Additional sampling and characterization efforts in this offsite area are currently in progress.

    - The area in the northeast part of the non-manufacturing area (commonly referred to as the Game Patron parking lot), where some chemicals also were detected in soil and groundwater at concentrations above Target Levels, and a component of groundwater flow to the north could result in chemical migration. Planning for additional characterization efforts in this area is in progress and will be implemented with other onsite investigations.

- Other individual locations where concentrations of chemicals above Target Levels were identified (and are illustrated on the figures in Section 3). At these locations, further evaluations of concentrations within the context of potential for exposure, relation to background concentrations, or other possible sources may be performed.

- *Objective: Provide data that would support evaluation and selection of source control and management measures.*
  - Information on exceedances of Target Levels in soil and groundwater will be used to determine the need for and extent of source control, management and treatment measures. Information currently being collected from the Offsite Investigation will be used to determine whether offsite migration has occurred and to indicate where control measures should be located.
  - Information on groundwater flow patterns and geology will also be used to evaluate the type and location of groundwater control measures, such as well locations.
  - Information that has been collected on general water chemistry and soil characteristics (such as chloride, dissolved iron and total iron) are sufficient to allow evaluation and selection of treatment, control and remedial measures, should they be necessary.

The results of the Perimeter Investigation will be integrated with other information (on site conditions, past and present land use, chemical fate and transport factors, etc.) to build on the current understanding of the Conceptual Site Model, which presents a comprehensive picture of the site. The Conceptual Site Model serves as the basis for understanding interrelationships between historical site activities; current site conditions; and potential migration, exposure, and corrective action scenarios. Where elements of the Conceptual Site Model are not well understood, investigation activities are focused to better characterize and understand these elements. As additional data are collected, this Conceptual Site Model will be updated and further documented in subsequent reports. The results of the Perimeter Investigation provided the following additional understanding to support the further development of the Site Conceptual Model:

- Because the site is generally flat and located on both a topographic and bedrock high point in elevation, the predominant source of groundwater beneath the site is infiltration from rainwater, rather than groundwater flow from offsite to onsite.
- Shallow or overburden groundwater flow patterns are influenced by site conditions such as the topography, the presence of impermeable surface materials (buildings, pavement, etc), the presence and extent of coarse-grained subsurface soils, and the depth and shape of the bedrock surface beneath the overburden. The absence of groundwater in soil borings along the south perimeter corresponds to areas of increasing surface slope, more semi-impermeable to impermeable ground cover (i.e., parking lots, roads, buildings), shallow depths to bedrock, and finer-grained subsurface soils. In addition, the bedrock high beneath the site generally influences groundwater to flow from the high toward the northwest, north and northeast and tends to prevent groundwater flow from the northern portion of the facility to the south and east. The rate and volume of groundwater flow is greatest along the western perimeter of the site, where the greatest

depth to bedrock, extent of saturated coarse grained layers or lenses, and the predominant hydraulic gradient direction is observed.

- The number of chemicals and percentage of analytical records with concentrations above Target Levels in soil suggests that the potential impact of Hoover-related activities in perimeter soils is spatially limited (particularly when concentrations of chemicals that could be derived from other sources or could be within background concentration ranges are considered). Preliminary evaluation suggests that the distribution of several SVOCs and metals (both Perimeter Investigation Target Analyte List and non-Target Analyte List chemicals) present at the perimeter above Target Levels are within the range of concentrations typically observed naturally or in urban areas (in other words, the presence of these chemicals are related to background occurrences of these chemicals and not to activities performed by Hoover). Further evaluation to better assess this interpretation is in progress.
- Because the limited number of non-Perimeter Investigation Target Analyte List constituents that were detected at concentrations above Target Levels may be derived from other sources, the use of a focused Target Analyte List can effectively characterize potentially site-related constituent distribution and concentrations.
- Concentrations of VOCs detected above Target Levels in groundwater are generally present along the western site perimeter in the direction of the predominant groundwater flow gradient and are unassociated with detections over Target Levels for these same chemicals in soil (i.e., these same chemicals are generally absent in soil). This information suggests that these chemicals are present in perimeter groundwater because of groundwater migration from onsite areas as opposed to migration via surface water infiltration at the perimeter.
- The detection of SVOCs and total metals in groundwater appears to correspond to the nature of the sample (whether it is a grab or monitoring well sample). Many of the detections reported for the groundwater grab samples appear to be related to the presence of suspended solids in the grab sample as opposed to indicating the presence of dissolved chemicals potentially migrating in groundwater.
- The concentrations of SVOCs and VOCs in groundwater at the perimeter are representative of dissolved phase, and not free product, at the facility perimeter.

SECTION 5

References

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Appendix A
Preliminary Risk Evaluation for Publicly Assessable Recreation Areas

Preliminary Risk Evaluation – Recreational Areas at Hoover Plant 1, North Canton, OH

Summary

A preliminary evaluation of human health risks was performed for chemical constituents of interest detected in shallow soil in publicly accessible recreational areas, on the northerly portion of The Hoover Company's (Hoover's) Plant 1 Facility in North Canton, OH. The purpose for this preliminary evaluation is to provide information for making near-term decisions regarding the need for and potential scope of additional investigation and/or remediation activities in these areas. It is not intended to support final decisions, or serve as a full risk assessment for this area. This preliminary evaluation was performed using highly conservative assumptions regarding the potential for exposure to constituents detected in soil, and in accordance with U.S. Environmental Protection Agency risk assessment guidelines (USEPA, 1989). Therefore, the results from this evaluation should overstate rather than understate the potential risks from constituents detected in soil.

The preliminary evaluation indicates that chemical concentrations detected in shallow soil in all recreational areas (these include the currently used baseball fields, soccer fields, practice football fields and former ballfield areas) fall within the range of risks specified in USEPA's risk reduction goal for corrective action (USEPA, 1996). Therefore there are no unacceptable risk to recreational users. To reach this conclusion shallow soil samples were collected and analyzed in December 1999 to evaluate the presence of chemicals, and were compared to conservative (health-protective) facility-specific Target Levels (CH2M HILL, 2000a). The following constituents were detected at concentrations that exceeded facility-specific Target Levels:

- Trichloroethylene (TCE) exceeded facility-specific Target Levels in 2 of 12 samples collected from the currently used baseball fields.
- Polycyclic aromatic hydrocarbons (PAHs) exceeded facility-specific Target Levels in 3 of 12 samples collected from the currently used baseball fields.
- Lead was detected in a single sample from the currently used baseball fields at a concentration higher than its facility-specific target level.
- Cadmium was detected in a single sample from formerly used ballfields at a concentration higher than its facility-specific target level.

A preliminary risk evaluation was performed for each of these constituents, based on the analytical results and conservative assumptions regarding potential exposure scenarios. The results from this preliminary evaluation show that using conservative assumptions, as outlined within this memorandum, risks from these chemicals in soil fall within the range specified by the U.S. Environmental Protection Agency's (USEPA) risk reduction goal for corrective action. In other words, the results from this conservative preliminary evaluation indicate that corrective action (or cleanup) should not be required to reduce risks associated

with these chemicals in soil. However, since concentrations higher than Target Levels were detected in some samples, additional sampling will be performed in the currently used ballfield areas in February 2000 to further evaluate these chemicals in soil. This preliminary evaluation will be updated with these additional results when they become available.

Finally, the results from this evaluation indicate that concentrations of PAHs in soil resemble urban background levels. The basis for these preliminary conclusions is outlined in further detail in the body of this document.

Investigation Site Setting

As a part of the Perimeter Investigation (CH2M HILL, 2000b), shallow soil samples were collected from areas accessible to the public in the northern portion of the facility. In addition to the general purpose of determining the nature and extent of constituents in environmental media, samples were collected in these areas to identify whether potential pathways of exposure existed associated with recreational uses of these public access areas. Currently, the public has access to parking lots, the baseball diamonds, and the soccer and practice football fields. Historically, the public has also had access to baseball fields in an area that is currently fenced and used as a truck parking area by Hoover (referred to as the former ballfield areas). These areas, and the locations of the shallow soil samples, are depicted on Figure 1.

In general, Hoover Plant 1 is located in a mixed residential, commercial, and industrial area near the center of North Canton in Stark County, Ohio. The plant is bordered to the north by residences and North Canton Hoover High School; to the east by the high school football field and residences; to the south by residences and the local YMCA; and to the west by commercial establishments and residences.

Preliminary Risk Evaluation Process

This preliminary risk evaluation was performed to provide conservative (health-protective) estimates of the potential risks to public health associated with chemicals detected in soil at concentrations exceeding site-specific Target Levels in the recreational areas. This evaluation is based on existing site-specific data from the Perimeter Investigation (CH2M HILL, 2000b), that will be supplemented as necessary by additional information to be obtained in future investigations. The preliminary risk evaluation focused on the constituents of interest identified using a conservative screening process. The potential for human exposure to these constituents is based on highly conservative assumptions. These assumptions are intended to ensure that the results of the evaluation will not underestimate the human health risk posed by the Site. In this manner results from this evaluation will overstate rather than understate the potential risks from constituents detected in soil.

The preliminary risk evaluation consisted of the following steps:

1) Sampling and analysis of shallow (0 to 2 feet below ground surface) soils in recreational areas of the facility
2) Selection of constituents of interest for potential exposure media in this area (i.e. surface soils) using a conservative screening process
3) Preliminary identification of potential exposure pathways and receptors associated with use of the recreational areas
4) Calculation of exposure levels and associated incremental health risks using conservative assumptions. This step includes identifying exposure point concentrations for each constituent of interest and presenting assumptions for all exposure parameters
5) Preliminary risk characterization, describing the nature of potential risks associated with the constituents detected in soil

These steps are outlined in the following sections

Step 1: Sampling and Analysis

Shallow soil samples (composite samples from the interval of 0 to 2 feet below ground surface) were collected from the currently-used baseball fields (12 samples), soccer fields (8 samples), practice football fields (6 samples) and former ballfield areas (11 samples). A total of 37 soil samples were collected from the publicly accessible recreation areas. The samples were located in a grid pattern in each area on approximately 120 foot spacings. This coverage was intended to place multiple samples within each area in order to provide data to identify the presence of chemical constituents in surface soil. Should constituents above Target Levels be detected, additional data collection would be performed to refine the evaluation of site risks. The sample locations are depicted on Figure 1. Based on a general understanding of past waste management practices and results of previous investigations at Plant 1 , a facility-specific list of constituents of interest was used to develop a "target analyte list" for the Perimeter Investigation. All samples from the recreational areas were analyzed for metals, semivolatile organic compounds and volatile organic compounds. Six of the 37 samples, or approximately 20 percent, were analyzed for the full suite of RCRA Appendix IX constituents, as confirmation of the appropriateness of the target analyte list. At least one sample was analyzed for RCRA Appendix IX constituents in each of the recreational areas addressed in this evaluation. The samples analyzed for the suite of RCRA Appendix IX constituents were SB-117, SB-177, SB-195, SB-201, SB-206 and SB-217.

Sampling, analysis and laboratory data quality assurance review were conducted in accordance with a quality assurance project plan (QAPP) (CH2M HILL, 2000c). The QAPP was prepared in accordance with USEPA Region 5 instructions for preparing QAPPs for corrective action projects (USEPA, 1998). Practical quantitation limits (PQLs) in the laboratory analyses were sufficiently low to detect concentrations in soil at or below facility-specific Target Levels. The USEPA-approved facility-specific Target Levels were developed according to the process described in the Voluntary Corrective Action Agreement (USEPA, 1999a), and were based on USEPA Region 5 residential risk-based screening levels, with the exception of benzo(a)pyrene (the risk-based screening level for benzo(a)pyrene was 0.09 mg/kg, while the PQL was 0.33 mg/kg). As shown below, benzo(a)pyrene was detected at concentrations higher than the PQL in three samples, and therefore was included in this preliminary evaluation.

Step 2: Selection of Constituents of Interest for the Preliminary Risk Evaluation

The constituents of interest for this preliminary evaluation are those detected in surface soils at levels that exceeded the facility-specific Target Levels. The constituent of interest selection process was as follows:

- Facility-specific Target Levels were developed in accordance with the procedures described in the Voluntary Corrective Action Agreement (USEPA, 1999a).

- Concentrations of analytes detected in all samples were compared to the facility-specific Target Levels;
- Analytes having concentrations in excess of the facility-specific Target Levels were included as constituents of interest in this preliminary risk evaluation;

This data evaluation and selection process for constituents of interest yielded the following results:

- The constituents of interest were lead, trichloroethylene (TCE), cadmium and the polycyclic aromatic hydrocarbons (PAHs) (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene).
- TCE was detected in eight of 37 samples collected from the recreational areas. Concentrations of TCE in two samples (SB-203 and SB-205) were higher than facility-specific Target Levels. The PAHs were detected only in three of 37 samples (SB-203, SB-204 and SB-205). PAHs were detected at concentrations higher than facility-specific Target Levels in these three samples. The PAHs benzo(k)fluoranthene and chrysene also were detected in three samples (SB-203, SB-204 and SB-205), but at concentrations lower than their facility-specific Target Levels.
- Lead was detected in all 37 samples collected from the recreational areas, but only one detection exceeded its facility-specific target level. This exceedence (462 mg/kg, compared to the facility-specific target level of 400 mg/kg) occurred at SB 205.
- Cadmium was detected in four of 37 samples, though only a single detection of 148 mg/kg at SB-216 (located in the formerly-used ballfields) was higher than its facility specific target level of 78 mg/kg. However, cadmium was not detected in adjacent samples. These results indicate that the occurrence of cadmium in the formerly-used ballfields is limited to a single sample. Correspondingly, there would be limited potential for exposure to cadmium in soil in this area. Additional sampling will be performed to address the potential presence or absence of cadmium in the area where the concentration was higher than the target level.
- Arsenic and beryllium were detected in the soil samples. Concentrations in some samples were slightly higher than facility-specific Target Levels that were based on background in soil. The background level for arsenic used in this investigation as a facility-specific target level was 13 mg/kg (OEPA, 1999). The background level for beryllium used in this investigation as a facility-specific target level was 0.54 mg/kg (Kabata-Pendias and Pendias, 1992). Arsenic was detected in 4 of 37 samples above its facility-specific target level. Beryllium was detected in a single sample above its facility-specific target level. Based on the general understanding of past waste management practices, arsenic or beryllium were not handled at the facility, and are therefore not expected to be Hoover-related constituents. They will, however, be investigated further to determine if they are naturally-occurring in soil. For these reasons, arsenic and beryllium were not chosen for preliminary risk evaluation at this time.

Step 3: Identification of Potential Exposure Pathways and Receptors

The current and historical use of this area is for recreational purposes. Based on use, populations that may come into contact with constituents detected in soil are understood to be adults (including high-school age adolescents), older children (ages 6 to 12) and younger children (ages 1 to 6). Potential exposure pathways have been identified as follows:

- From PAHs and lead detected in soil, the potential exposure pathways are assumed to be soil ingestion and dermal contact with soil.
- The potential exposure pathway from the VOCs (trichloroethylene) in soil is assumed to be inhalation, soil ingestion and dermal contact with soil.

These represent the populations and potential exposure pathways that were addressed in this preliminary risk evaluation. The populations identified represent all age ranges (young children, older children and adults) that might be present at the ballfields.

Step 4: Exposure and Risk Evaluation

Potential exposures and risks were evaluated using intake equations published in guidance developed by the U.S. Environmental Protection Agency (USEPA, 1989; USEPA, 1999b). Estimated risks were calculated using reasonable maximum exposure assumptions (in accordance with guidance provided in USEPA, 1989) and the highest concentrations detected at the site (found in soil boring SB-205). Whenever possible, standard default exposure factors were used in estimating potential exposure (USEPA, 1991a; USEPA, 1999c). Additional guidance for developing exposure assumptions was obtained from USEPA, 1997 and USEPA, 1999c. The exposure parameters used in calculated chemical intakes are summarized in Table 3.

Estimates of excess lifetime cancer risks (ELCR) associated with the estimated intakes (for PAHs and TCE) were calculated using slope factors obtained from the National Center for Environmental Assessment's (NCEA) Integrated Risk Information System (IRIS) database. The inhalation slope factor for TCE were obtained from the Superfund Risk Technical Support Center in Cincinnati, OH. Relative potency factors for individual carcinogenic PAHs were obtained from USEPA, 1993. The results from the risk evaluation are presented in Table 4.

Step 5: Preliminary Risk Characterization

Based on the process described above, the following preliminary characterizations were developed.

<u>PAHs and TCE</u>. The ELCRs for PAHs and TCE are based on several conservative exposure assumptions, as shown in Table 3 that overstate the potential risks associated with these chemicals in soil. The results from this preliminary evaluation show that using conservative assumptions, risks from these chemicals in soil fall within the range specified by the U.S. Environmental Protection Agency's (USEPA) risk reduction goal for corrective action. As

shown in Table 4, the estimated ELCR for each scenario falls within the risk range of 1 x 10^{-6} to 1 x 10^{-4} defined in U.S. Environmental Protection Agency (USEPA) risk reduction goal for corrective action (USEPA, 1991b; USEPA, 1996). Because the results fall within this range, additional investigation will be performed, but no remedial actions are warranted at this time. Generally, USEPA considers action to be warranted at a site when risks exceed 1 x 10^{-4}, and action is not typically required for risks falling within 1 x 10^{-4} to 1 x 10^{-6}. However this is judged on a case-by-case basis. Risks less than 1 x 10^{-6} generally are not of concern to regulatory agencies (USEPA, 1991b).

Lead. Under the recreational exposure scenario, lead detected in soil in the ballfields falls below a health-based screening level based on the potential exposure pathways of soil ingestion and dermal contact with soil.

Lead concentrations in soil were compared with the 400 mg/kg screening level for lead in soil in residential areas, calculated using the Integrated Exposure Uptake Biokinetic Model (IEUBK) model. This screening level is based on residential land use assumptions, which are more conservative than the site-specific recreational use assumptions used to evaluate the ballfields. The purpose for this screening level is to limit potential exposure to soil lead levels such that a child that was exposed to this level on a daily basis would have an estimated risk of no more than 5% of exceeding a 10 ug/dL (micrograms per deciliter) blood lead level. This 10 ug/dL blood lead level is based upon analyses conducted by the Centers for Disease Control and EPA that associate blood lead levels of 10 ug/dL and higher with health effects in children; however, this blood lead level is below a level that would trigger medical intervention. As noted in USEPA guidance, the 400 mg/kg level is not intended to be a "cleanup level" but only to serve as an indicator that further study is appropriate (USEPA, 1994). Evaluation of lead concentrations in soil involved the following steps:

- **Comparison of the highest concentration detected with the screening level.** In the case of the ballfields, the highest concentration of lead (462 mg/kg) was greater than the target level of 400 mg/kg. This comparison was intended to be the most conservative and is based on the assumption that an individual is exposed to the maximum concentration of 462 mg/kg of lead in soil on a daily basis. However, USEPA guidance (USEPA, 1989; USEPA, 1992) states that the average concentration in soil is most representative of the concentration that would be contacted at a site over time. Therefore, as described below, the average concentration of lead was compared to the screening level.
- **Comparison of the average concentration with the screening level.** Per USEPA guidance as referenced above, an assumption was made that an individual could potentially come into contact with soil across the entire ballfields area. Based on this assumption, the average concentration in soil was calculated from lead detected in all 12 of the soil samples. The average concentration of lead in soil was 88 mg/kg, while the 95 percent upper confidence limit (UCL) was 219 mg/kg, calculated according to the procedure presented in USEPA, 1992. USEPA guidance states that "because of the uncertainty associated with any estimate of exposure concentration, the upper confidence limit [i.e. the 95 percent upper confidence limit] on the arithmetic average will be used for this variable" (USEPA, 1989; USEPA, 1992). Therefore, the UCL on the average concentration (219 mg/kg) was considered a more reasonable estimate of

potential long-term contact with lead in soil at the ballfields. Since the UCL concentration (219 mg/kg) is lower than the 400 mg/kg target level, this preliminary evaluation indicates that lead in soil in the ballfields falls below a level of concern for health effects in children, based on USEPA guidance (USEPA, 1994) for evaluating lead in soil.

Cadmium in the formerly-used ballfields. Cadmium was detected at a concentration of 148 mg/kg in a single sample from the formerly-used ballfields, which is above its facility-specific target level of 78 mg/kg. Surrounding samples in the formerly-used ballfields did not detect cadmium. These analytical results suggest that cadmium, if present, is likely to be found only in a single sample in the formerly-used ballfields. Therefore, the potential for exposure under a recreational use scenario, is likely to be limited. Since surrounding samples did not detect cadmium, additional sampling will be performed to confirm the presence or absence of cadmium in soil, in order to further evaluate cadmium in the preliminary risk evaluation.

Evaluation of environmental levels of PAHs. PAHs are ubiquitous in the environment. The concentrations in soil resemble levels typically found in the environment. Concentrations in soil were compared with urban background concentrations from different literature sources. These comparisons are summarized in Table 5. The concentrations of PAHs in soil resemble concentrations reported as urban background in the literature. The comparison of PAHs detected in the ballfield with urban background concentrations suggests that the potential risks associated with PAHs in soil in the baseball fields would be no different from risks from PAHs ordinarily encountered in urban areas. While additional investigations of PAHs will be done in this area, remedial action is not warranted at this time.

Uncertainties and Levels of Conservatism. This preliminary evaluation is based on conservative methods and assumptions. The methods used in this preliminary risk evaluation tend to overstate rather than understate risks associated with chemicals detected in soil at the baseball fields. Many of the assumptions (including soil ingestion rate, dermal adherence factor, exposed skin surface area and exposure point concentrations) either achieve or exceed the RME scenario. Estimates of potential exposure to PAHs and TCE are based on the assumption that users of the ball fields will come into contact with the highest concentrations detected in a single soil sample during the entire duration of exposure. Assumptions with some uncertainty, such as exposure frequency and exposure duration, were estimated in a conservative manner (see the rationale for each assumption shown in Table 3).

Conclusions. Chemical concentrations detected in shallow soil in the currently-used ballfields fall within the range of risks specified in USEPA's risk reduction goal for corrective action, for users of the fields under the exposure scenarios described above. Concentrations of PAHs in soil resemble urban background levels. Cadmium was detected in a single sample in the formerly-used ballfields, indicating that there is limited potential for exposure to this constituent. Additional sampling will be performed to further evaluate the potential for exposure to cadmium in this area.

Further Investigation in Currently Used Ballfield Area

The results from this preliminary evaluation show that risks from chemicals in soil fall within the range specified by USEPA's risk reduction goal for corrective action. In other words, the results from this evaluation indicate that corrective action (or cleanup) should not be required to reduce risks associated with these chemicals in soil. However, since concentrations higher than Target Levels were detected in some samples, additional investigation of the currently used ballfields will be performed during February 2000 to provide additional information on the nature, extent and potential source of the constituents. Sample locations proposed are illustrated on Figure 2 and include:

- Additional shallow soils samples from surface (0 to 6 inches below ground surface) and near-surface soils (0 to 2 feet below ground surface) in the baseball field area that bound the area where previous sample results indicated concentrations above screening levels in the currently used field. This information will be used to assess exposure pathways and risk potential.
- Additional deeper soil samples from 2 feet to approximately the top of the groundwater surface to understand the vertical extent of constituents (particularly TCE) exceeding Target Levels in the currently used baseball field area.
- Groundwater samples at the groundwater surface at specified locations in the currently used baseball field area. This information will be used to determine if constituents exceeding Target Levels are present in groundwater and, if they are present, whether they are acting as a potential source for volatilization to the surface.
- Groundwater samples at the top of bedrock at specified locations in the currently used baseball field area to determine if there is a deep constituent source or migration pathway.

The target analyte list for additional sampling, along with the reasons for selection of the analytes, is shown below. Analyses for RCRA Appendix IX constituents are not included, because these constituents were not detected in the initial sampling event at concentrations above facility-specific Target Levels.

Metals

- Lead – further evaluate concentrations of constituent detected above Target Levels
- Cadmium - one shallow soil sample (0-2 feet) will be collected from sample location SB-232 (Figure 2) and analyzed for cadmium. This sample will be used to confirm the presence or absence of cadmium which was detected at a concentration that exceeded its facility-specific target level during the December 1999 investigation.

Semivolatile Organic Compounds

- Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene – further evaluate concentrations of constituents detected above Target Levels in the ballfield area

Table 1
Summary of Analytical Results in the Currently-Used Baseball Fields
The Hoover Company

Constituent	Number of Samples	Number of Detects	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)
Benzo(a)anthracene	12	3	1.8	3.8
Benzo(a)pyrene	12	3	1.6	3.3
Benzo(b)fluoranthene	12	3	2.1	4.2
Indeno(1,2,3-cd)pyrene	12	3	1	2.2
Lead	12	12	14.9	462
Trichloroethene	12	5	0.0069	6.6

Note:
Maximum detected concentrations were all found in the same sample (soil boring SB-205)
Maximum detected concentrations were used as the exposure point concentrations in this preliminary risk evaluation.
A upper confidence limit (UCL) on the average was calculated for lead. The UCL = 219 mg/kg.

Table 2
Comparison of Analytical Results in Currently Used Baseball Fields to Facility-Specific Target Levels
The Hoover Company

Parameter	Units	HVRSB112-1299SN0002 Lab Results[1]	HVRSB112-1299SN0002 Lab Qualifier	HVRSB113-0100SN0002 Lab Results[1]	HVRSB113-0100SN0002 Lab Qualifier	HVRSB114-1299SN0002 Lab Results[1]	HVRSB114-1299SN0002 Lab Qualifier	Facility-Specific Target Level Value	Facility-Specific Target Level Basis
Benzo(A)Anthracene	mg/kg	0.39	U	0.4	U	0.39	U	0.9	RBSL
Benzo(A)Pyrene	mg/kg	0.39	U	0.4	U	0.39	U	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	0.39	U	0.4	U	0.39	U	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	0.39	U	0.4	U	0.39	U	9	RBSL
Chrysene	mg/kg	0.39	U	0.4	U	0.39	U	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	0.39	U	0.4	U	0.39	U	0.9	RBSL
Lead	mg/kg	19.1	=	50.1	=	153	=	400	RBSL
Trichloroethene	mg/kg	0.84	=	0.015	=	0.0046	U	5	RBSL

Parameter	Units	HVRSB115-1199SN0002 Lab Results[1]	HVRSB115-1199SN0002 Lab Qualifier	HVRSB116-1299SN0002 Lab Results[1]	HVRSB116-1299SN0002 Lab Qualifier	HVRSB117-1299SN0002 Lab Results[1]	HVRSB117-1299SN0002 Lab Qualifier	Facility-Specific Target Level Value	Facility-Specific Target Level Basis
Benzo(A)Anthracene	mg/kg	0.38	U	0.38	U	0.38	U	0.9	RBSL
Benzo(A)Pyrene	mg/kg	0.38	U	0.38	U	0.38	U	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	0.38	U	0.38	U	0.38	U	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	0.38	U	0.38	U	0.38	U	9	RBSL
Chrysene	mg/kg	0.38	U	0.38	U	0.38	U	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	0.38	U	0.38	U	0.38	U	0.9	RBSL
Lead	mg/kg	17.7	=	14.9	=	24.1	=	400	RBSL
Trichloroethene	mg/kg	0.0047	U	0.0044	U	0.0047	U	5	RBSL

Table 2

Comparison of Analytical Results in Currently Used Baseball Fields to Facility-Specific Target Levels

The Hoover Company

Parameter	Units	Sample ID: HVRSB118-0100SN0002 Lab Results[1]	Lab Qualifier	HVRSB203-1299SN0002 Lab Results[1]	Lab Qualifier	HVRSB204-1299SN0002 Lab Results[1]	Lab Qualifier	Facility-Specific Target Level: Value	Basis
Benzo(A)Anthracene	mg/kg	0.39	U	**1.8**	=	**2.5**	=	0.9	RBSL
Benzo(A)Pyrene	mg/kg	0.39	U	**1.6**	=	**2.1**	=	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	0.39	U	**2.1**	=	**3**	=	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	0.39	U	0.79	=	1.1	=	9	RBSL
Chrysene	mg/kg	0.39	U	1.7	=	2.6	=	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	0.39	U	**1**	=	**1.5**	=	0.9	RBSL
Lead	mg/kg	66.6	=	59.6	=	95.5	=	400	RBSL
Trichloroethene	mg/kg	0.0051	U	**5.1**	=	0.0069	=	5	RBSL

Parameter	Units	Sample ID: HVRSB205-1299SN0002 Lab Results[1]	Lab Qualifier	HVRSB206-1299SN0002 Lab Results[1]	Lab Qualifier	HVRSB207-1299SN0002 Lab Results[1]	Lab Qualifier	Facility-Specific Target Level: Value	Basis
Benzo(A)Anthracene	mg/kg	**3.8**	=	0.37	U	0.38	U	0.9	RBSL
Benzo(A)Pyrene	mg/kg	**3.3**	=	0.37	U	0.38	U	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	**4.2**	=	0.37	U	0.38	U	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	1.9	=	0.37	U	0.38	U	9	RBSL
Chrysene	mg/kg	3.7	=	0.37	U	0.38	U	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	**2.2**	=	0.37	U	0.38	U	0.9	RBSL
Lead	mg/kg	**462**	=	94.3	=	28.2	=	400	RBSL
Trichloroethene	mg/kg	**6.6**	=	0.0044	U	0.0048	U	5	RBSL

Table 2
Comparison of Analytical Results in Currently Used Baseball Fields to Facility-Specific Target Levels
The Hoover Company

Comparison of Analytical Results for Cadmium in Former Ballfield Area to Facility-Specific Target Levels

		Sample ID								Facility-Specific Target Level	
		HVRSB208-1299SN0002		HVRSB209-1299SN0002		HVRSB210-1299SN0002		HVRSB211-1299SN0002		Value	Basis
Parameter	Units	Lab Result	Qualifier	Lab Result	Qualifier	Lab Result	Qualifier	Lab Result	Qualifier		
Cadmium	mg/kg	0.609	U	0.605	U	0.614	U	0.606	U	78	RBSL

		Sample ID								Facility-Specific Target Level	
		HVRSB212-1299SN0002		HVRSB213-1299SN0002		HVRSB214-1299SN0002		HVRSB215-1299SN0002		Value	Basis
Parameter	Units	Lab Result	Qualifier	Lab Result	Qualifier	Lab Result	Qualifier	Lab Result	Qualifier		
Cadmium	mg/kg	0.604	U	0.614	U	0.596	U	0.621	U	78	RBSL

		Sample ID							Facility-Specific Target Level	
		HVRSB216-1299SN0002		HVRSB217-1299SN0002		HVRSB218-1299SN0002			Value	Basis
Parameter	Units	Lab Result	Qualifier	Lab Result	Qualifier	Lab Result	Qualifier			
Cadmium	mg/kg	148	=	0.607	U	0.654	U		78	RBSL

Notes:
U - Not detected. Value presented is the sample quantitation limit.
= - Detected concentration
[1] Lab results qualified with a "U" are reported at the sample quantitation limit (SQL). The SQL for soil samples is the analytical practical quantitation limit (PQL) adjusted for soil moisture and sample dilution. The laboratory participating on this project has elected to set their soil PQLs at 330 ug/kg, (consistent with guidance developed under the USEPA Contract Laboratory Program). prior to adjustment of individual sample results for soil moisture and dilution. Based on the results of the preliminary risk evaluation, concentrations at the SQL do not represent an unacceptable health risk. Unacceptable health risks could potentially be associated with concentrations above 10 mg/kg.

Source of Facility-Specific Target Levels:
RBSL - Risk-based screening level, presented in USEPA, 1998 Appendix D.
PQL - Practical Quantitation Limit (PQL is higher than the RBSL for benzo(a)pyrene).

Table 3

Summary of Exposure Assumptions

The Hoover Company

Description	Scenario			Notes
	Ballplayer	Child Spectator+Ballplayer	Adult Spectator	
Exposure frequency (days/year)	175	175	175	275 days/yr. with mean temp. >32°F. minus 100 days from Mar. - Nov. with >0.01 in. rainfall based on data from the National Weather Service
Exposure duration - adult (days/year)	NA	6	12	Values are based on the assumption that a ballplayer plays at the field from the age of 6 to 12 years (exposure duration = 6 years), and as a young child is a spectator from the age of 1 to 6 years (exposure duration = 6 years). One scenario was evaluated for a child assumed to be at the baseball field for 12 years, 6 years as a spectator and 6 years as a ballplayer. A parent is assumed to be at the ball field for a period of 12 years.
Exposure duration - child (days/year)	6	6	NA	See the previous note
Soil ingestion rate - adult (mg/day)	NA	NA	100	USEPA, 1991
Soil ingestion rate - child (mg/day)	100	200 (ages 1 through 6) 100 ages (6 through 12)	NA	Adult soil ingestion rate is assumed to be applicable for older children (ages 6 to 12). Child (age 1 to 6) soil ingestion rate was obtained from USEPA, 1991.
Exposed skin surface area - adult (cm^2/day)	NA	NA	5700	USEPA, 1999a; USEPA, 1999b
Exposed skin surface area - child (cm^2/day)	4500	2800 (ages 1 through 6) 4500 (ages 6 through 12)	NA	For children ages 6 through 12 (the ballplayer scenario), skin surface area is assumed to be 10,000 cm2; mean % total surface area for hands + arms + legs = 44.91%) (USEPA, 1997, Tbls. 6-6 - 6-9). Child default skin surface area (ages 1 through 6) is obtained from USEPA, 1999a, 1999b.
Inhalation rate - adult (m^3/day)	NA	NA	4.8	(assumes 3 hrs duration each day @ 1.6 m3/hr. [moderate activity]) (USEPA, 1997 - Tbl. 5-23)
Inhalation rate - child (m^3/day)	3.6	3.6	NA	(assumes 3 hrs duration each day @ 1.2 m3/hr. [moderate activity]) (USEPA, 1997 - Tbl. 5-23)
Body weight - adult (kg)	NA	NA	70	
Body weight - child (kg)	38	15 (ages 1 through 6) 38 (ages 6 through 12)	NA	Child (1 to 6 years) body weight is the default value (USEPA, 1991). Body weight for child ages 6 through 12 is obtained from USEPA, 1997, Table 7-2.
Soil to skin adherence factor (mg/cm^2)	0.2	0.2	0.07	USEPA, 1999a; USEPA, 1999b
Averaging time - carcinogenic substances (years)	70	70	70	USEPA, 1989
Averaging time - noncarcinogenic substances (years)	6	12	12	Set equal to exposure duration according to USEPA, 1989

NA - Exposure assumption is not applicable to this scenario.

Table 4
Risk Evaluation Summary
The Hoover Company

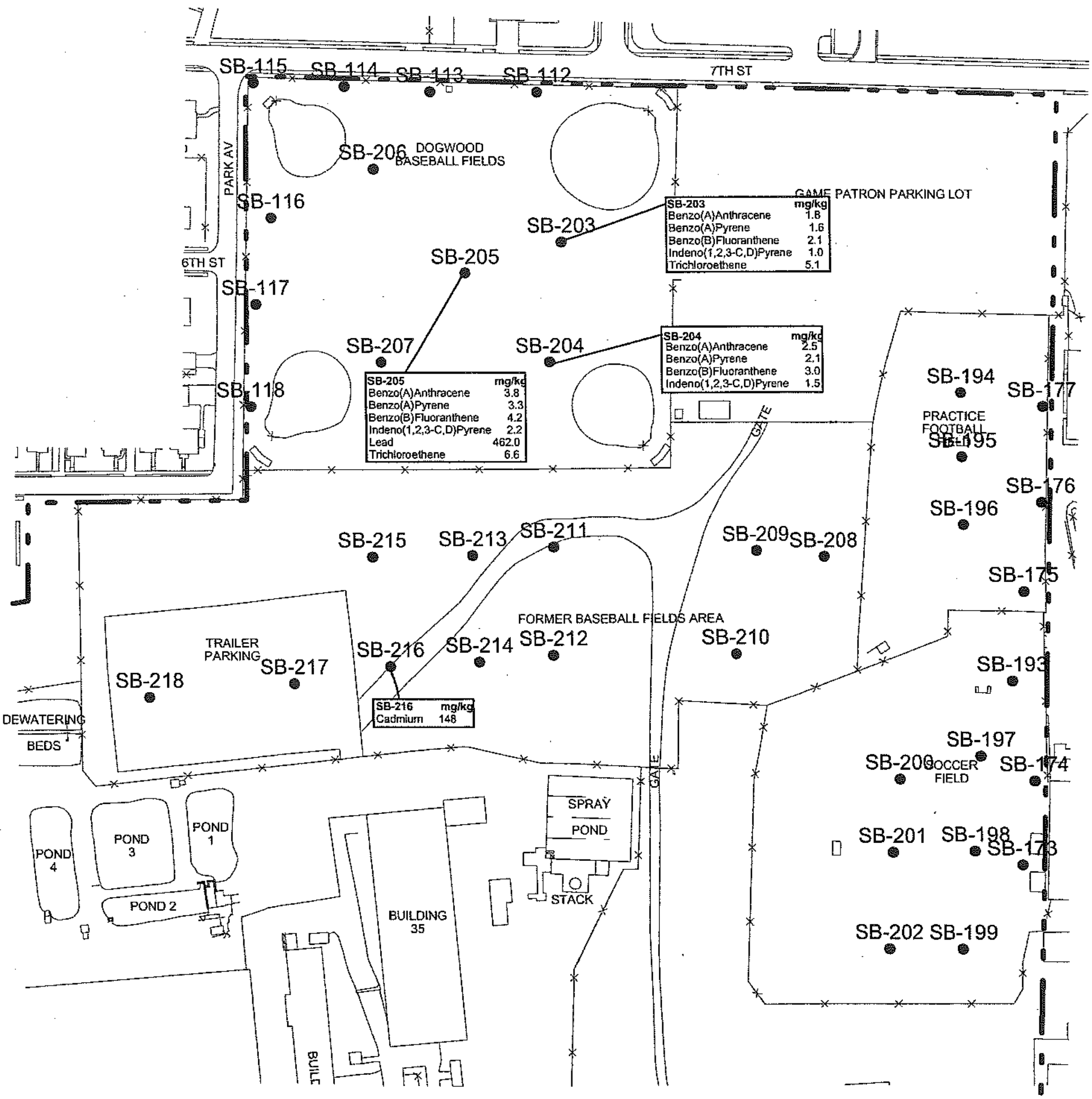
Exposure Scenario	Estimated Excess Lifetime Cancer Risk[1]
Ballplayer Scenario	8 in 1,000,000
Child Spectator plus Ballplayer Scenario	3 in 100,000
Adult Spectator Scenario	6 in 1,000,000

Chemical	Estimated Excess Lifetime Cancer Risks, by Chemical and Exposure Pathway											
	Ballplayer Scenario				Child Spectator plus Ballplayer Scenario				Adult Spectator Scenario			
	Soil Ingestion	Dermal Contact	Inhalation	Total Risk	Soil Ingestion	Dermal Contact	Inhalation	Total Risk	Soil Ingestion	Dermal Contact	Inhalation	Total Risk
Benzo(a)anthracene	3E-07	4E-07		7E-07	2E-06	9E-07		3E-06	3E-07	2E-07		5E-07
Benzo(a)pyrene	3E-06	3E-06		6E-06	1E-05	8E-06		2E-05	3E-06	1E-06		4E-06
Benzo(b)fluoranthene	3E-07	4E-07		7E-07	2E-06	1E-06		3E-06	4E-07	2E-07		5E-07
Indeno(1,2,3-cd)pyrene	2E-07	2E-07		4E-07	1E-06	5E-07		2E-06	2E-07	1E-07		3E-07
Trichloroethylene[2]	8E-09	7E-09	2E-07	2E-07	5E-08	2E-08	7E-07	8E-07	9E-09	3E-09	4E-07	4E-07
Total Estimated Risk				**8E-06**				**3E-05**				**6E-06**

Notes:
[1]EPA's risk reduction goal is to reduce the threat from carcinogenic contaminants such that the excess lifetime cancer risk falls within a range from 1E-06 to 1E-04 (USEPA, 1996).
[2]The concentration of TCE in air associated with emissions from soil was estimated using the default volatilization factor of 2,600 m^3/kg (USEPA, 1999b).
Note on exponential notation: 8E-06 is the same as 8 in 1,000,000.

Table 5
Comparison of Site-Related PAH Concentrations with Urban Background Concentrations
The Hoover Company

PAH	Background Concentrations in Urban Soils				Concentrations Detected in Baseball Fields	
	ATSDR, 1995		Bradley et al., 1994			
	Minimum value	Maximum value	Minimum value	Maximum value	Minimum value	Maximum value
Benzo(a)anthracene	0.169	59	0.048	15	1.8	3.8
Benzo(a)pyrene	0.165	0.22	0.04	13	1.6	3.3
Benzo(b)fluoranthene	15	62	0.049	12	2.1	4.2
Indeno(1,2,3-cd)pyrene	8	61	0.093	6	1	2.2



LEGEND

SB-203 Soil boring identifier and location

Approximate property boundary

North

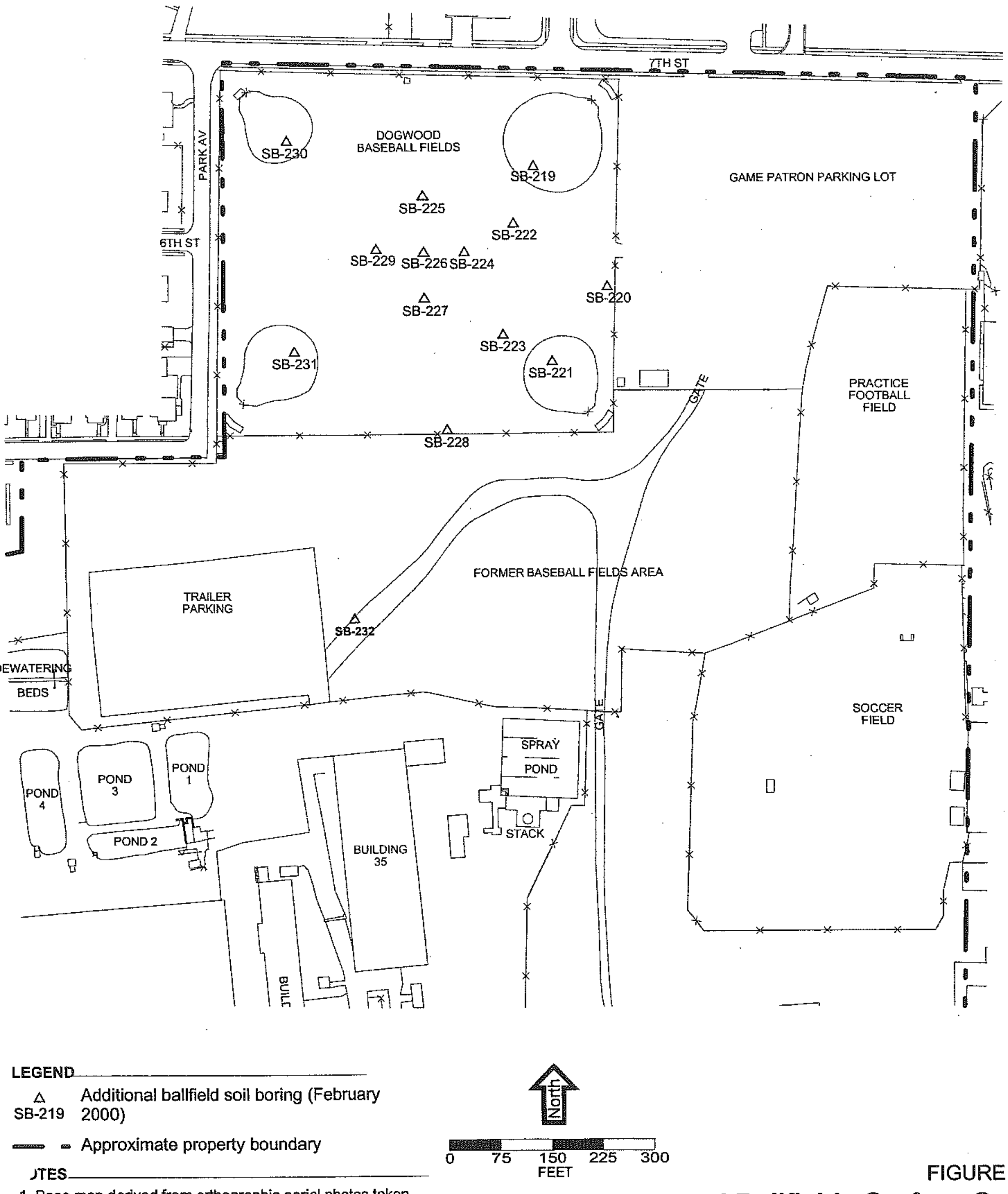
0 75 150 225 300
FEET

NOTES

1. Base map derived from orthographic aerial photos taken January 17, 2000.
2. All samples were collected in November and December 1999, and results are presented in mg/kg.
3. The analytical results presented here are concentrations higher than USEPA Region V RBSLs.

FIGURE 1
Ballfields Surface Soil (0-2 ft) Sampling Locations
The Hoover Company, North Canton, Ohio
CH2M HILL

DAY1/j:/hoover/surffigs/allballfields_ltr3.srf (ballfiled_survey.dat) 05/08/00



LEGEND

△ SB-219 — Additional ballfield soil boring (February 2000)

— — Approximate property boundary

NOTES

1. Base map derived from orthographic aerial photos taken January 17, 2000.
2. All samples were collected in February 2000, and results are presented in mg/kg.
3. The analytical results presented here are concentrations higher than facility-specific target levels.

FIGURE 2

Proposed Ballfields Surface Soil Sampling Locations

The Hoover Company, North Canton, Ohio

CH2MHILL

DAY1/j:/hoover/surffigs/allballfieldsfeb_proposed.srf (ALLBLFD5.DAT) 05/08/00

Appendix B
Dogwood Baseball Fields Technical Memorandums

The Hoover Company Dogwood Baseball Fields Additional Investigation

TO: Monica Satrape/The Hoover Company

FROM: CH2M HILL

DATE: February 21, 2000

Purpose

This memorandum provides a record of the additional field investigation conducted at The Hoover Company Dogwood Baseball Fields (February 2000). The Dogwood Baseball Fields investigation was performed to provide additional data needed to further characterize the ball fields playing area. The additional investigation started on February 11, 2000 and was completed by February 16, 2000.

Drilling and Sampling Locations

The actual drilling and sampling locations were consistent with the locations planned (*Proposed Approach to Public Access Areas Investigation*, CH2M Hill 2000a) and are documented in "Addendum to the Preliminary Risk Evaluation- Recreational Areas at Hoover Plant 1, North Canton, OH" (CH2M HILL 2000b). The depth and location of soil samples taken is illustrated in Table 1.

Drilling and Sampling Techniques

Two 4 ¼-inch inside diameter (I.D.) Hollow Stem Auger (HSA) rigs were utilized to drill at the identified sampling locations.

Soil Sampling

Soil samples were collected using two different techniques. Surface soil samples were collected from depths of 0 to 6 inches and 0 to 2 feet at each identified location. A 2-inch stainless steel split spoon was manually driven to the required sampling depth and a soil sample was collected. The alternative method of manually driving the split spoons was used due to wet field conditions that would render using a drill rig less effective.

A HSA rig was used to drill to the deeper soil and ground-water sampling intervals. A 3-inch stainless steel split spoon was used to sample the soil. Methods utilized for soil sampling are referenced in the *RCRA Facility Investigation, Perimeter Investigation Sampling and Analysis Plan* (CH2M HILL 2000c, Revised February 2000).

Table 1 Soil Samples Identification and Depth

BORE HOLE NAME	SOIL SAMPLES								
	0-6 inch SOIL SAMPLE	0-2 feet SOIL SAMPLE	4-6 feet SOIL SAMPLE	8-10 feet SOIL SAMPLE	12-14 feet SOIL SAMPLE	16-18 feet SOIL SAMPLE	SOIL EQUIP. BLANK	SOIL DUPLIC.	SOIL MS/MSD
219	X*	X					X	X	
220	X	X	X	X					
221	X	X							
222	X	X	X	X	X	X			
223	X	X	X	X	X		X		
224	X	X							
225	X	X							X
226	X	X	X	X					
227	X	X	X					X	
228	X	X							
229	X	X					X		
230	X	X							
231	X	X						X	
232		X**							

X* - Two sets of samples taken at this location. An additional sample was taken as a result of preliminary data evaluation needs assessment based on preliminary results.
X**- Soil sample taken for cadmium ONLY.

Soil Logging

The soil logging activities for the identified drilling locations in the field are as follows:

Locations	Soil Logging Depth
226	Soil was logged from surface to bedrock
220, 222, 223, 228	Soil was logged from surface to water table interface
219, 221, 224, 225, 227, 229, 230, 231, and 232	Soil was logged from surface to depth of 2 feet

Water Sampling

Water samples were collected at the water table interface and at bedrock. A temporary well (1-inch diameter PVC screen and risers) was placed in the bore hole and the sample was collected from the well using a peristaltic pump. Methods utilized are referenced in the *RCRA Facility Investigation, Perimeter Investigation Sampling and Analysis Plan* (CH2M HILL 2000c, Revised February 2000).

The location of groundwater samples taken is illustrated in Table 2.

Table 2 Groundwater Samples Identification

BORE HOLE #	GROUNDWATER SAMPLES					
	GROUND-WATER TABLE SAMPLE	BEDROCK SAMPLE	DUPLICATE SAMPLE	EQUIP. BLANK SAMPLE	MS/MSD SAMPLE	TRIP BLANK
220	X	X				X
222	INSUFFICIENT WATER, NO GROUNDWATER SAMPLES TAKEN*					
223	X		X		X	X
226	INSUFFICIENT WATER, NO GROUNDWATER SAMPLES TAKEN*					
228	X	X		X		X

*Per Standard Operating Procedure 5.5 - Installation of Temporary Well Points for Groundwater Sampling

Analytical Suites

Soil and ground-water samples collected from the Dogwood Baseball Fields were analyzed for Lead (Dissolved and Total), PAHs, and VOCs. Refer to the *Proposed Approach to Public Access Areas Investigation* (CH2M HILL 2000a).

References

CH2M HILL. Proposed Approach to Public Access Areas Investigation. 2000a.

CH2M HILL. Addendum to the Preliminary Risk Evaluation – Recreational Areas at Hoover Plant 1, North Canton, OH. 2000b.

CH2M HILL. RCRA Facility Investigation, *Perimeter Investigation Sampling and Analysis Plan*. 1999b. Revised February 2000. 2000c.

Dogwood Baseball Fields Subsurface Investigation

TO: Monica Satrape/The Hoover Company

FROM: CH2M HILL/DAY Office

COPIES: Kathy Arnett/CH2M HILL
Lauri Gorton/CH2M HILL

DATE: May 5, 2000

Summary

The Perimeter Investigation collected physical and chemical data along the perimeter of the Hoover facility and onsite recreational areas (*RCRA Facility Investigation Perimeter Investigation Report*, CH2M HILL, 2000a) from November 1999 through February 2000. Preliminary evaluations of Perimeter Investigation analytical results for shallow soil data (0-2 feet below ground surface) indicated that a small number of chemicals had been detected at concentrations which exceeded Target Levels. These analytical results were used to complete a preliminary risk evaluation for the onsite recreational areas in the northern portion of the Hoover facility. Conclusions from this preliminary risk evaluation are found in "Preliminary Risk Evaluation – Recreational Areas at Hoover Plant 1, North Canton, OH" (CH2M HILL, 2000b).

In order to confirm the results of the preliminary risk evaluation, a supplementary investigation in the Dogwood Baseball Fields was completed in February 2000. The Dogwood Baseball Fields Investigation was performed to delineate the nature and extent of chemicals that were detected in surface soil at concentrations above Target Levels during the Perimeter Investigation. Surficial soil data (0-0.5 and 0-2 feet) collected during the Dogwood Baseball Fields Investigation were used to refine the preliminary risk evaluation at the Dogwood Baseball Fields. The conclusions of the Dogwood Baseball Fields risk evaluation were summarized in the "Addendum to the Preliminary Risk Evaluation – Recreational Areas at Hoover Plant 1, North Canton, OH" (CH2M HILL, 2000c).

This memorandum summarizes the subsurface soil (with a depth of greater than 2 feet below ground surface) and groundwater sampling results from the Dogwood Baseball Fields Investigation. Surficial soil data were evaluated in the Dogwood Baseball Fields preliminary risk assessment and, therefore, these shallow soil data are not re-assessed in this technical memorandum. The Dogwood Baseball Fields analyte list corresponds to chemicals detected above Target Levels in the onsite recreational areas during the Perimeter Investigation. The chemicals included in the analytical suite are a subset of the chlorinated volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs, which are also SVOCs), and lead. Analytical results from the Dogwood Baseball Fields subsurface samples were evaluated by comparing them to the conservative Target Levels established as part of the Perimeter Investigation (which were based on a residential exposure scenario). The summary of these results indicate that:

- Chlorinated VOCs did not exceed Target Levels in collected soil samples.

- Only one chlorinated VOC, vinyl chloride, was detect above Target Levels in groundwater in three of five groundwater samples.
- The following PAHs exceeded soil Target Levels in the 12 soil samples: benzo(a)anthracene (1 sample), benzo(a)pyrene (2 sample), benzo(b)fluoranthene (1 sample), and indeno(1,2,3-cd)pyrene (1 sample).
- No groundwater PAHs were detected.
- No other semivolatiles exceeded Target Levels in soil or groundwater.
- Lead exceeded Target Levels in 1 of the 12 subsurface soil samples.
- Lead was not detected above target level in the filtered groundwater samples.

Introduction

As part of the Perimeter Investigation, surface and subsurface soil and groundwater samples were collected from November 1999 through February 2000 along the Hoover Plant 1 property boundary, and surface soil samples were collected in areas accessible to the public for recreational use. The "Preliminary Risk Evaluation – Recreational Areas at Hoover Plant 1, North Canton, OH" (CH2M HILL, 2000b) reviewed analytical results from Perimeter Investigation in the onsite recreational areas. This review concluded that:

- Surface soil constituents had been detected at levels exceeding site-specific Target Levels at three locations in the area of the Dogwood Baseball Fields. Chemicals that exceeded Target Levels at one or more surface soil samples were: trichloroethylene (TCE), polycyclic aromatic hydrocarbons (PAHs), and lead.
- The vertical extent of was not determined since sampling locations in the center of the Dogwood Baseball Fields where soil Target Levels were exceeded extended to a maximum depth of 2 feet below ground surface.
- Chemical concentrations detected in surface soil fall within the range of risks specified in USEPA's risk reduction goal of corrective action (USEPA, 1996).

The "Preliminary Risk Evaluation – Recreational Areas at Hoover Plant 1, North Canton, OH" (CH2M HILL, 2000b) report recommended further investigation in the Dogwood Baseball Fields to provide additional information on the nature, extent, and potential source of chemicals that exceeded Target Levels. The sampling schedule and objectives for the Dogwood Baseball Fields Investigation were:

- Additional surface soil samples (0-0.5 foot and 0-2 feet) to assess exposure pathways and risk potential.
- Additional deeper soil samples from 2 feet below ground surface (bgs) to the top of groundwater to understand the vertical extent of constituents.
- Groundwater samples to determine if chemicals that exceed Target Levels are present in groundwater and, if present, whether chemicals (in particular TCE) act as a source to surface soils due to migration by volatilization to soil from groundwater.
- Groundwater samples at the top of bedrock to determine if there is a deep chemical source or migration pathway.

The additional sampling in the Dogwood Baseball Fields was completed in February 2000. Perimeter Investigation and the Dogwood Baseball Fields Investigation surface soil data were assessed in the "Addendum to the Preliminary Risk Evaluation – Recreational Areas at Hoover Plant 1, North Canton, OH" (CH2M HILL, 2000c), and are not repeated here. Subsurface data from the Dogwood Baseball Fields Investigation are reviewed in this memorandum.

An analytical suite specific to the Dogwood Baseball Fields Investigation was derived from those chemicals detected in the onsite recreational areas at concentrations that exceeded Target Levels during the Perimeter Investigation. These constituents are volatiles, semivolatiles (including PAHs), and lead. Volatiles in the chemical list were trichloroethene (TCE) and its degradation products, which are 1,1,1-trichloroethane, tetrachloroethylene (PCE), 1,1-dichloroethane, 1,1-dichloroethylene, cis- and trans-1,2-dichloroethylene and vinyl chloride. Soil and groundwater samples also were analyzed for lead, the semivolatiles bis(2-ethylhexyl)phthalate, and the PAHs (which are SVOCs) benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-CD)pyrene. PAHs and lead were detected above target level in surface soil in the Dogwood Baseball Fields during the Perimeter Investigation.

The data for this additional evaluation of subsurface soil and groundwater data from the Dogwood Baseball Fields Investigation are presented in the following sections:

- **Sampling and Analytical Approach** describes the sample locations, sample depths and constituents analyzed in each sample.
- **Physical Conditions** describes the characteristics of subsurface soils and groundwater observed during this evaluation.
- **Analytical Results** presents the results from analyses of soil and groundwater samples collected during this evaluation.
- **Conclusions** combines the observations of physical conditions with the analytical results to develop conclusions regarding the occurrence of constituents in the subsurface and their potential for further migration.

Sampling and Analytical Approach

The approach to the Dogwood Baseball Fields Investigation is detailed in *Proposed Approach to Public Access Areas Investigation* (CH2M HILL, 2000d) and is summarized below:

- Shallow soil samples (0-0.5 foot and 0-2 feet below ground surface) were taken from 13 locations. These data were used to assess exposure pathway and risk potential (note – this evaluation was completed in "Addendum to the Preliminary Risk Evaluation – Recreational Areas at Hoover Plant 1, North Canton, OH" (CH2M HILL, 2000c)).
- Subsurface soil (greater than 2 feet below ground surface) and groundwater samples were collected at the water table and bedrock at five locations. These data were used to determine if chemicals are acting as a potential source for volatilization to the surface and if there is a deep chemical source or pathway.

The 5 locations of subsurface soil and groundwater samples are illustrated in Figure 1. Target analyte sample types and intervals sampled during the Dogwood Baseball Fields Investigation are listed in Table 1. Sampling, analytical methods, and field procedures were performed in accordance with the *RCRA Facility Investigation, Perimeter Investigation Sampling and Analysis Plan* (CH2M HILL, 1999). Subsurface soil was sampled at SB-220, SB-222, SB-223, SB-226, and SB-228. Subsurface groundwater sampling was planned for five locations but completed at only three because the soils at two locations (SB-222 and SB-226) soils did not yield enough water for a groundwater sample. The target analyte list is listed in the footnote in Table 1.

Physical Conditions

Topography and Ground Cover

The Dogwood Baseball Fields are relatively flat with ground elevations ranging from 1,152 to 1,154 feet above the National Geodetic Vertical Datum of 1988. There are four baseball diamonds at the corners of the Dogwood Baseball Fields. Ground cover on each diamond is fine-grained infield material, and the area in between each baseball diamond is turf.

Soils

A geological cross section was created from north to south in the Dogwood Baseball Fields (Figure 1). The lithology in this cross section (Figure 2) is divided into three groups. To maintain consistency, these lithologic groupings are the same as those used in the *RCRA Facility Investigation Perimeter Investigation Report* (CH2M HILL, 2000a).

- **Coarse-Grained Deposits** (sand, gravel, and sand and gravel). This grouping is called "coarse" in this memorandum.
- **Coarse-Grained Deposits with Fines** (sand with silt/clay, gravel with silt/clay, and sand/gravel with silt/clay). This grouping is called "mixed" in this memorandum.
- **Fine-Grained Deposits** (silt/clay, and silt/clay with sand/gravel). This grouping is called "fine" in this memorandum.

This cross section shows that the predominant soil in the Dogwood Baseball Fields area is fine, with lenses of coarse and mixed material. The lenses are typically less than 5 feet thick and extend less than 200 feet in lateral extent. In general there is more coarse-grained material to the south than in the north. There is some uncertainty in the subsurface extent of the lenses because sampling protocol stated that soil logging would stop after the water table was encountered. Thus, SB-220 and SB-228 were not completed below the water table.

Fill was identified in all five subsurface borings. Fill is defined as non-native materials such as construction rubble (brick, concrete, metal) , road fill (gravel and asphalt) and industrial fill ("blue material" [likely plastic pieces] identified from visual observations of the samples in the boring logs, glass, metal, ash, fibers). Fill thickness ranged from 4 to 8 feet below ground, and fill materials generally were mixed with sand, gravel, silt, and clay. Fill material and extent are summarized below:

- Fill in SB-220 extended to 8 feet below ground and consisted of road and industrial fill.
- Fill in SB-222 extended to 4 feet below ground and consisted of construction, road, and industrial fill.
- Fill in SB-223 extended to 4 feet below ground and consisted of construction and industrial fill.

- Fill in SB-226 extended to 4 feet below ground and consisted of construction and industrial fill.
- Fill in SB-228 extended to 4 feet below ground and consisted of industrial, construction, and road fill.

Based on the depth to groundwater of 9.5 feet measured in the nearest monitoring well (MW-15S) and the shallowest water level identified in the borings (SB-228, at 6 to 8 feet), the fill was not found to be generally in contact with the groundwater.

Bedrock

Bedrock was encountered from 12 to 25 feet below ground surface in the Dogwood Baseball Fields Investigation borings. The bedrock was identified at each location but typically was not penetrated more than 1 foot. Shale was identified at one location (SB-220) and sandstone was identified at the other borings. Bedrock surface elevations from the Dogwood Baseball Fields Investigation show that the bedrock surface drops toward the northeast and southwest of the Dogwood Baseball Fields area. This finding corroborates the findings of the *RCRA Facility Investigation Perimeter Investigation Report* (CH2M HILL, 2000a), which identified a bedrock high that extends diagonally through the Dogwood Baseball Fields from the southeast toward the northwest. This bedrock surface from the bedrock high slopes downward toward the northeast and southwest.

Groundwater

Groundwater depths in the Dogwood Baseball Fields Investigation soil borings were estimated to the nearest foot based on soil saturation and the apparent water table observed at the boreholes. These depths to saturated soil were variable and ranged from 6 to 14 feet below ground surface. At two locations (SB-222 and SB-226) groundwater was not encountered since the saturated interval was too tight to yield enough water to collect a groundwater sample (Table 1). The groundwater depth at the nearby MW-15S, which was installed during the Perimeter Investigation, was 9.5 feet below ground on January 27, 2000. This depth to groundwater is consistent with the water levels identified in the three borings where groundwater was identified during the Dogwood Baseball Fields Investigation.

Analytical Results

Analytical results for subsurface soil are presented in Table 2 and for groundwater in Table 3. Frequency summaries are presented in Tables 4 and 5. Soil and groundwater samples were analyzed a suite of chemicals specific to the Dogwood Baseball Fields Investigation. This analytical suite was determined from chemicals that exceeded the Target Levels during the Perimeter Investigation, and chemicals that might be volatile breakdown products of TCE, which exceeded Target Levels:

- Volatiles - trichloroethene (TCE), and its chemical breakdown products 1,1,1-trichloroethane, tetrachloroethylene (PCE), 1,1-dichloroethane, 1,1-dichloroethylene, cis- and trans-1,2-dichloroethylene and vinyl chloride.
- Semivolatiles - bis(2-ethylhexyl)phthalate, and PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-CD)pyrene).

- Metals – lead.

The following sections summarize pertinent results. Figure 3 shows chemicals that exceed Target Levels.

Surface Soil

Surface soil (0-0.5 foot and 0-2 feet below ground surface) data and interpretation are summarized in the "Addendum to the Preliminary Risk Evaluation – Recreational Areas at Hoover Plant 1, North Canton, OH" (CH2M HILL, 2000c).

Subsurface Soil

"Subsurface soil" means all soil more than 2 feet below ground. Twelve subsurface soil samples were taken at five locations as part of this Dogwood Baseball Fields Investigation (Figure 3). Of 192 subsurface soil analyses, 6 concentrations (or 3 percent) exceeded Target Levels.

No Chlorinated VOCs exceeded Target Levels in soil at the five subsurface soil locations. PAHs exceeded Target Levels in soil at two of the five locations. Lead exceeded target level in soil at one location (Figure 3). Specifically, the following chemicals exceeded Target Levels in soil:

- PAH, Benzo(a)anthracene (SB-226, 4-6 feet bgs).
- PAH, Benzo(a)pyrene (SB-220, 4-6 feet bgs, and SB-226, 4-6 feet bgs).
- PAH, Benzo(b)fluoranthene (SB-226, 4-6 feet bgs).
- PAH, Indeno(1,2,3-c,d)pyrene (SB-226, 4-6 feet bgs).
- Lead (SB-220, 4-6 feet bgs).

PAH exceedances of Target Levels appear to correlate with encountered fill intervals in the 4 to 6 feet below ground surface range. Given that PAHs are associated with asphalt, the construction fill material may be a source for these PAHs. The exposure pathway associated with these subsurface soils (at a depth of 4 to 6 feet below ground surface) is a that of a construction worker that would be working within a subsurface trench or excavation.

The lead soil concentration at one (SB-220) of the 12 locations was higher than the target level. Again, because this concentration was detected at a depth of 4 to 6 feet, the exposure pathway associated with to soil at a depth of 4 to 6 feet bgs is for a construction worker.

VOCs and the SVOC (bis(2-ethylhexyl)phthalate) did not exceed Target Levels in any soil samples.

Table 2 summarizes the analytical results for the soil samples. The number of detections and detections that exceeded Target Levels for each compound are listed in Table 4.

Groundwater

Groundwater samples were taken at the water table and at the bedrock interface (see Sampling and Analytical Approach). Five samples were taken from 3 of the 5 locations as part of the Dogwood Baseball Fields Investigation (Table 1). Table 3 summarizes the analytical results for the groundwater samples. The number of detections that exceeded Target Levels for each compound are listed in Table 5.

Of the 80 groundwater analyses, 3 concentrations (4 percent) exceeded Target Levels (Table 5). All 3 of these target level exceedances were for vinyl chloride, and an exceedance occurred at each of the 3 locations sampled (Figure 3). Vinyl chloride exceeded Target Levels at the water table in one (SB-223, 14-16 feet bgs) of the three water table samples, and in both (SB-220 24-26 feet bgs and SB-228 14-16 feet bgs) of bedrock groundwater samples. Dissolved lead and semi volatile concentrations were below Target Levels (Table 3 and Table 5). For this analysis, results from total (unfiltered) lead in groundwater are not assessed because of possible high results due to acid preservation of turbid samples. High dissolved metals can result when unfiltered groundwater samples are acidified. Adding acid dissolves metals in suspended solids, which increases the apparent dissolved metals concentration when the groundwater sample is analyzed.

Conclusions

The Dogwood Baseball Fields Investigation satisfied its sampling objectives:

- Assess exposure pathways and risk potential in surface soil – assessed in the "Addendum to the Preliminary Risk Evaluation – Recreational Areas at Hoover Plant 1, North Canton, OH" (CH2M HILL, 2000c).
- Assess nature and extent of subsurface soil constituents that exceed Target Levels – determined that some semivolatile PAHs exceed target criteria up to 6 feet below ground surface, and that these PAHs are correlated with the occurrence of fill. There was one exceedance of lead above Target Levels, and this is also associated with fill. There were no volatile exceedances of Target Levels in subsurface soil.
- Determine nature and extent of groundwater constituents at the water table and at bedrock, and determine if groundwater constituents are a potential source for soil chemicals – vinyl chloride was detected above the target level in one of the three water table ground water samples, and in both of the bedrock groundwater samples. Lead and semivolatile chemicals did not exceed Target Levels in the Dogwood Baseball Fields samples. Vinyl chloride was not detected in the subsurface soil above the groundwater. Therefore, vinyl chloride in groundwater is not acting as a source for soil chemicals via volatilization or another mechanism.

Dogwood Baseball Fields Investigation physical conditions agree with those from the *RCRA Facility Investigation Perimeter Investigation Report* (CH2M HILL, 2000a):

- Unconsolidated geology is primarily fine with lenses of mixed and coarse materials. This characterization is the same as those in the Perimeter Investigation Report.
- Fill depth extent in the center of the Dogwood Baseball Fields was not known after the Perimeter Investigation, and was quantified in the Dogwood Baseball Fields Investigation as being generally 4 feet bgs to up to 8 feet bgs in the eastern portion of the Dogwood Baseball Fields area.
- Data from the Dogwood Baseball Fields Investigation indicate that the bedrock surface slopes toward the northeast. This corroborates the conclusion in the Perimeter Investigation Report that there is a bedrock high that runs through the Dogwood

Baseball Fields from southeast to northwest, with the bedrock surface sloping down toward the northeast and southwest.

- Groundwater levels in the Dogwood Baseball Fields Investigation were in general agreement with those found during the Perimeter Investigation.

The Dogwood Baseball Fields Investigation augmented the understanding of the nature and extent of chemicals in soil and groundwater:

- Surface soil results are summarized in the "Addendum to the Preliminary Risk Evaluation - Recreational Areas at Hoover Plant 1, North Canton, OH" (CH2M HILL, 2000c).
- PAH semivolatiles exceeded Target Levels in 2 of the 12 subsurface soil samples. There was 1 sample where lead exceeded Target Levels. PAH and lead exceedances are correlated with fill, which extends generally to 4 feet bgs and up to 8 feet bgs. There were no exceedance volatiles, including TCE, which was detected above the Target Levels in surface soil during the Perimeter Investigation.
- Vinyl chloride exceeded Target Levels in 3 of the 5 groundwater samples, including 1 of the 3 water table groundwater samples and both of the bedrock groundwater samples.

Exposure Pathways

- Subsurface soil exceedances of lead and PAHs occurred for sample intervals 4-6 feet bgs at two locations. Due to this depth the most likely exposure is to a construction worker who is excavating this soil.
- Groundwater exceedances of vinyl chloride occurred in groundwater samples as shallow as 6 feet bgs and as deep as 26 feet bgs. At this depth the most likely exposure is to a construction worker who is excavating the soil at these depths.
- Groundwater chemicals exceeding Target Levels (vinyl chloride) were not detected in subsurface soil. This indicates that these chemicals are not volatilizing and migrating upward above the water table where they were detected above Target Levels. Therefore, volatilization of groundwater chemicals is not a likely exposure pathway.

References

CH2M HILL. 1999. RCRA Facility Investigation, Perimeter Investigation Sampling and Analysis Plan.

CH2M HILL. 2000a. RCRA Facility Investigation Perimeter Investigation Report.

CH2M HILL. 2000b. Preliminary Risk Evaluation - Recreational Areas at Hoover Plant 1, North Canton, OH.

CH2M HILL. 2000c. Addendum to the Preliminary Risk Evaluation - Recreational Areas at Hoover Plant 1, North Canton, OH.

CH2M HILL. 2000d. Proposed Approach to Public Access Areas Investigation.

U.S. Environmental Protection Agency. 1996. Corrective Action for Releases from Solid Waste Management Units at Hazardous Waste Management Facilities; Proposed Rule. *Federal Register.* 61 (85): 19432-64.

TABLE 1
Summary of Subsurface Soil and Groundwater Samples from the Dogwood Baseball Fields Investigation
The Hoover Company - Dogwood Baseball Fields Investigation

Borehole Number	Borehole Depth Intervals (feet below ground surface)					
	Soil Samples				Groundwater Samples	
	4–6	8–10	12–14	16–18	Water Table	Bedrock
220	X	X			X (10-12)	X (24-26)
222	X	X	X	X	NE	
223	X	X	X		X (14-16)	NA
226	X	X			NE	
228	X				X (6-8)	X (14-16)

X - indicates a sample was collected from this interval.
NE - groundwater not encountered
NA - not applicable
Target Analytes

Volatiles: 1,1,1-Trichloroethane; Trichloroethene; Tetrachloroethene; Vinyl chloride, cis-1,2-Dichloroethene; trans-1,2-Dichloroethene, 1,1-Dichloroethene, 1,1-Dichloroethane

Semivolatiles: bis(2-ethylhexyl)phthalate and PAHs [Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Indeno(1,2,3-cd)pyrene]
Metals: lead

TABLE 2
Soil Data from the Dogwood Baseball Fields Investigation (February 2000 Sampling Events)
The Hoover Company - Dogwood Baseball Fields Investigation

		Sample Identifier												
		HVRSB220-0200SN0406		HVRSB220-0200SN0810		HVRSB222-0200SN0406		HVRSB222-0200SN0810		HVRSB222-0200SN1214		HVRSB222-0200SN1618		
Constituent	Units	Lab Result	Lab Qualifier	Lab Result	Lab Qualifier	Lab Result	Lab Qualifier	Lab Result	Lab Qualifier	Lab Result	Lab Qualifier	Lab Result	Lab Qualifier	Target Levels ($\mu g/L$)
1,1,1-Trichloroethane	$\mu g/kg$	6.2	U	5.3	U	4.6	U	5.1	U	4.4	U	4.2	U	1200000
1,1-Dichloroethane	$\mu g/kg$	6.2	U	5.3	U	4.6	U	5.1	U	4.4	U	4.2	U	
1,1-Dichloroethene	$\mu g/kg$	6.2	U	5.3	U	4.6	U	5.1	U	4.4	U	4.2	U	70
Benzo(A)Anthracene	$\mu g/kg$	300	=	24	=	58	=	6.3	U	5.6	U	5.6	U	900
Benzo(A)Pyrene	$\mu g/kg$	**380**	=	33	=	58	=	6.3	U	5.6	U	5.7	=	330
Benzo(B)Fluoranthene	$\mu g/kg$	340	=	30	=	52	=	6.3	U	5.6	U	7.7	=	900
Benzo(K)Fluoranthene	$\mu g/kg$	150	=	14	=	27	=	6.3	U	5.6	U	5.6	U	9000
Bis(2-Ethylhexyl) Phthalate	$\mu g/kg$	2900	U	280	U	540	U	290	U	260	U	260	U	46000
Chrysene	$\mu g/kg$	190	=	15	=	34	=	6.3	U	5.6	U	5.6	U	88000
cis-1,2-Dichloroethene	$\mu g/kg$	3.1	U	2.7	U	2.3	U	2.5	U	2.2	U	2.1	U	42000
Indeno(1,2,3-C,D)Pyrene	$\mu g/kg$	220	=	19	=	31	=	6.3	U	5.6	U	5.6	U	900
Lead	$\mu g/kg$	**1190000**	=	10100	=	16000	=	14200	=	4320	=	13100	=	400000
Tetrachloroethene	$\mu g/kg$	6.2	U	5.3	U	4.6	U	5.1	U	4.4	U	4.2	U	11000
trans-1,2-Dichloroethene	$\mu g/kg$	3.1	U	2.7	U	2.3	U	2.5	U	2.2	U	2.1	U	1600000
Trichloroethene	$\mu g/kg$	7.5	=	5.3	U	4.6	U	5.1	U	4.4	U	4.2	U	5000
Vinyl Chloride	$\mu g/kg$	12	U	11	U	9.1	U	10	U	8.9	U	8.4	U	30

		Sample Identifier												
		HVRSB223-0200SN0406		HVRSB223-0200SN0810		HVRSB223-0200SN1214		HVRSB226-0200SN0406		HVRSB226-0200SN0810		HVRSB228-0200SN0406		
Constituent	Units	Lab Result	Lab Qualifier	Lab Result	Lab Qualifier	Lab Result	Lab Qualifier	Lab Result	Lab Qualifier	Lab Result	Lab Qualifier	Lab Result	Lab Qualifier	Target Levels ($\mu g/L$)
1,1,1-Trichloroethane	$\mu g/kg$	4.2	U	5.8	U	4.8	U	4.8	U	4.8	U	4.9	U	1200000
1,1-Dichloroethane	$\mu g/kg$	4.2	U	5.8	U	4.8	U	4.8	U	4.8	U	4.9	U	
1,1-Dichloroethene	$\mu g/kg$	4.2	U	5.8	U	4.8	U	4.8	U	4.8	U	4.9	U	70
Benzo(A)Anthracene	$\mu g/kg$	7.6	=	69	=	6	U	**4300**	=	5.8	U	6.2	U	900
Benzo(A)Pyrene	$\mu g/kg$	8.8	=	80	=	6	U	**3900**	=	5.8	U	6.2	U	330
Benzo(B)Fluoranthene	$\mu g/kg$	9.3	=	100	=	6	U	**4100**	=	5.8	U	6.2	U	900
Benzo(K)Fluoranthene	$\mu g/kg$	5.8	U	41	=	6	U	**1300**	=	5.8	U	6.2	U	9000
Bis(2-Ethylhexyl) Phthalate	$\mu g/kg$	270	U	600	U	270	U	25000	U	270	U	290	U	46000
Chrysene	$\mu g/kg$	5.8	U	96	=	6	U	2200	=	5.8	U	6.2	U	88000
cis-1,2-Dichloroethene	$\mu g/kg$	2.1	U	2.9	U	2.4	U	11	=	2.4	U	2.5	U	42000
Indeno(1,2,3-C,D)Pyrene	$\mu g/kg$	5.8	U	45	=	6	U	1800	=	5.8	U	6.2	U	900
Lead	$\mu g/kg$	19000	=	92800	=	13000	=	353000	=	25800	=	15100	=	400000
Tetrachloroethene	$\mu g/kg$	4.2	U	5.8	U	4.8	U	4.8	U	4.8	U	4.9	U	11000
trans-1,2-Dichloroethene	$\mu g/kg$	2.1	U	2.9	U	2.4	U	2.4	U	2.4	U	2.5	U	1600000
Trichloroethene	$\mu g/kg$	4.2	U	5.8	U	4.8	U	4.8	U	4.8	U	4.9	U	5000
Vinyl Chloride	$\mu g/kg$	8.4	U	12	U	9.6	U	9.6	U	9.6	U	9.9	U	30

Notes:
U - Not detected. Value presented is the sample quantitation limit.
= - Detected concentration.
Bold - indicates constituent concentration was equal to or greater than the target level.
Lab results qualified with a "U" are reported at the sample quantitation limit (SQL). The SQL for soil samples is the analytical practical quantitation limit (PQL) adjusted for soil moisture and sample dilution. During the December 1999 sampling event, the laboratory participating on this project has elected to set their soil PQLs for PAHs at 330 $\mu g/kg$, (consistent with guidance developed under the USEPA Contract Laboratory Program for Method 8270 analyses) prior to adjustment of individual sample results for soil moisture and dilution. Based on the results of the preliminary risk evaluation, concentrations at the SQL do not represent an unacceptable health risk. Unacceptable health risks could potentially be associated with PAH concentrations above 10 mg/kg.
PAHs in soil samples collected during February 2000 were analyzed using Method 8270SIM, which can obtain lower analytical reporting limits.
<u>Notes on reading sample names:</u>
The sample name can be best understood by breaking it into parts: **HVR(location name)-(month)(year)(media type)(sample type)(sample depth)**. For example, a soil sample obtained from 4 to 6 feet below ground from SB220 in February 2000, would be designated: **HVRSB220-0200SN0406**.

TABLE 3

Groundwater Data from the Dogwood Baseball Fields Investigation (February 2000 Sampling Events)

The Hoover Company - Dogwood Baseball Fields Investigation

Constituent	Units	Sample Identifier						Target Levels (µg/L)
		HVRSB220-0200WN1012		HVRSB220-0200WN2426		HVRSB223-0200WD1416		
		Lab Result	Lab Qualifier	Lab Result	Lab Qualifier	Lab Result	Lab Qualifier	
1,1,1-Trichloroethane	µg/L	1	U	1	U	1	U	200
1,1-Dichloroethane	µg/L	1	U	1	U	1	U	
1,1-Dichloroethene	µg/L	1	U	1	U	1	U	7
Benzo(A)Anthracene	µg/L	0.02	U	0.02	U	0.02	U	0.09
Benzo(A)Pyrene	µg/L	0.02	U	0.02	U	0.02	U	0.2
Benzo(B)Fluoranthene	µg/L	0.02	U	0.02	U	0.02	U	0.09
Benzo(K)Fluoranthene	µg/L	0.02	U	0.02	U	0.02	U	0.9
Bis(2-Ethylhexyl) Phthalate	µg/L	6	U	6	U	6	U	10
Chrysene	µg/L	0.02	U	0.02	U	0.02	U	9
cis-1,2-Dichloroethene	µg/L	0.58	=	6.6	=	2.2	=	70
Indeno(1,2,3-C,D)Pyrene	µg/L	0.02	U	0.02	U	0.02	U	0.09
Lead (total)	µg/L	7.6	=	11	=	38.3	=	15
Lead (filtered)	µg/L	3	U	3	U	3	U	15
Tetrachloroethene	µg/L	1	U	1	U	1	U	5
trans-1,2-Dichloroethene	µg/L	0.5	U	0.5	U	0.5	U	100
Trichloroethene	µg/L	1	U	1	U	1	U	5
Vinyl Chloride	µg/L	2	U	**3.8**	=	**3.5**	=	2

Constituent	Units	Sample Identifier						Target Levels (µg/L)
		HVRSB223-0200WN1416		HVRSB228-0200WN0608		HVRSB228-0200WN1416		
		Lab Result	Lab Qualifier	Lab Result	Lab Qualifier	Lab Result	Lab Qualifier	
1,1,1-Trichloroethane	µg/L	1	U	1	U	1	U	200
1,1-Dichloroethane	µg/L	1	U	1	U	1	U	
1,1-Dichloroethene	µg/L	1	U	1	U	1	U	7
Benzo(A)Anthracene	µg/L	0.02	U	0.02	U	0.02	U	0.09
Benzo(A)Pyrene	µg/L	0.02	U	0.02	U	0.02	U	0.2
Benzo(B)Fluoranthene	µg/L	0.02	U	0.02	U	0.02	U	0.09
Benzo(K)Fluoranthene	µg/L	0.02	U	0.02	U	0.02	U	0.9
Bis(2-Ethylhexyl) Phthalate	µg/L	6	U	6	U	6	U	10
Chrysene	µg/L	0.02	U	0.02	U	0.02	U	9
cis-1,2-Dichloroethene	µg/L	2.1	=	0.51	=	0.5	U	70
Indeno(1,2,3-C,D)Pyrene	µg/L	0.02	U	0.02	U	0.02	U	0.09
Lead (total)	µg/L	53.4	=	56.2	=	28.8	=	15
Lead (filtered)	µg/L	3	U	3	U	3	U	15
Tetrachloroethene	µg/L	1	U	1	U	1	U	5
trans-1,2-Dichloroethene	µg/L	0.5	U	0.5	U	0.5	U	100
Trichloroethene	µg/L	1	U	1	=	1	U	5
Vinyl Chloride	µg/L	**3.4**	=	2	U	**2.7**	=	2

Notes:
N/A - Not Analyzed
U - Not detected. Value presented is the sample quantitation limit.
= - Detected concentration

Lab results qualified with a "U" are reported at the sample quantitation limit (SQL).
Sample HVRSB223-0200WD1416 is a field duplicate of HVRSB223-0200WN1416
Notes on reading sample names: The sample name can be best understood by breaking it into parts:
HVR(location name)-(month)(year)(media type)(sample type)(sample depth). For example, a water sample obtained from 14 to 16 feet below ground from SB-223 in February 2000, would be designated: **HVRSB223-0200WN1416**

TABLE 4

Soil Data Statistical Summary from the Dogwood Baseball Fields Investigation (February 2000 Sampling Events)

The Hoover Company - Dogwood Baseball Fields Investigation

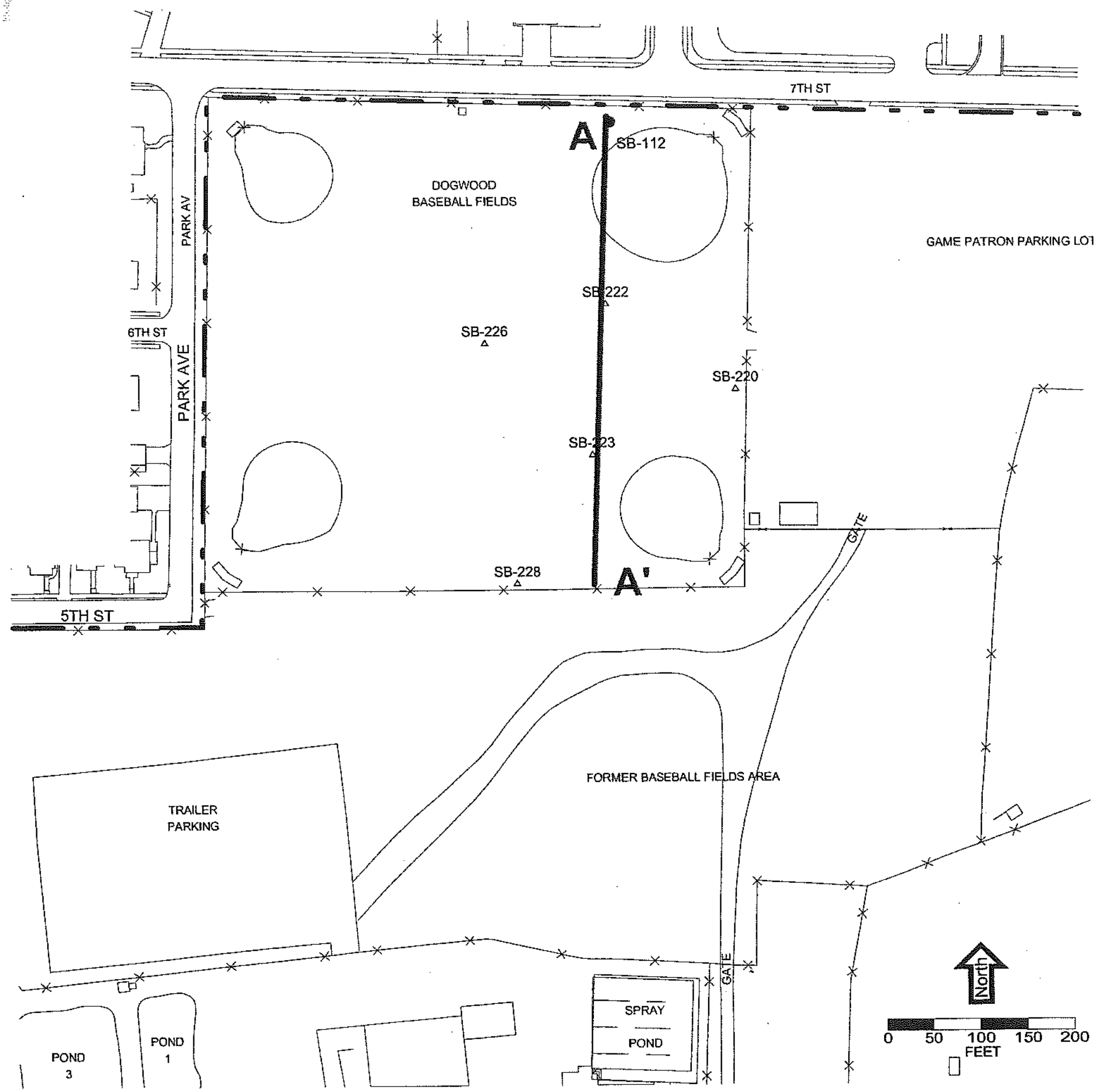
	Sampling	Samples		Concentrations (μg/kg)				
Constituent	Locations	Number	Detections	Maximum	Minimum	Mean	Target Level	Samples Above Target Levels
1,1,1-Trichloroethane	5	12	0				1200000	0
1,1-Dichloroethene	5	12	0				70	0
1,1-Dichloroethane	5	12	0				NA	NA
Benzo(A)Anthracene	5	12	6	**4300**	7.6	793	900	1
Benzo(A)Pyrene	5	12	7	**3900**	5.7	638	330	2
Benzo(B)Fluoranthene	5	12	7	**4100**	7.7	663	900	1
Benzo(K)Fluoranthene	5	12	5	1300	14	306	9000	0
Bis(2-Ethylhexyl) Phthalate	5	12	0				46000	0
Chrysene	5	12	5	2200	15	507	88000	0
cis-1,2-Dichloroethene	5	12	1	11	11	11	42000	0
Indeno(1,2,3-C,D)Pyrene	5	12	5	**1800**	19	423	900	1
Lead	5	12	12	**1190000**	4320	147201	400000	1
Tetrachloroethene	5	12	0				11000	0
trans-1,2-Dichloroethene	5	12	0				1600000	0
Trichloroethene	5	12	1	7.5	7.5	7.500	5000	0
Vinyl Chloride	5	12	0				30	0
Sum		192	49					6

NA = not applicable

TABLE 5
Groundwater Data Statistical Summary from Dogwood Baseball Fields Investigation (February 2000 Sampling Events)
The Hoover Company - Dogwood Baseball Fields Investigation

Constituent	Sample Locations	Samples Number	Samples Detections	Concentrations (µg/L) Maximum	Concentrations (µg/L) Minimum	Concentrations (µg/L) Mean	Target Level	Samples Above Target Levels
1,1,1-Trichloroethane	3	5	0				200	0
1,1-Dichloroethene	3	5	0				7	0
1,1-Dichloroethane	3	5	0				NA	NA
Benzo(A)Anthracene	3	5	0				0.09	0
Benzo(A)Pyrene	3	5	0				0.2	0
Benzo(B)Fluoranthene	3	5	0				0.09	0
Benzo(K)Fluoranthene	3	5	0				0.9	0
Bis(2-Ethylhexyl) Phthalate	3	5	0				10	0
Chrysene	3	5	0				9	0
cis-1,2-Dichloroethene	3	5	4	6.6	0.51	2.4	70	0
Indeno(1,2,3-C,D)Pyrene	3	5	0				0.09	0
Lead (filtered)	3	5	0				15	0
Lead (total)	3	5	5	56.2	7.6	31	15	3
Tetrachloroethene	3	5	0				5	0
trans-1,2-Dichloroethene	3	5	0				100	0
Trichloroethene	3	5	1	1	1	1	5	0
Vinyl Chloride	3	5	3	3.8	2.7	3.3	2	3
	Sum	80	8					3

NA = not applicable
This summary does not include the duplicate sample at SB-223 at the interval 14-16 feet bgs



LEGEND

SB-219 Ballfield subsurface soil boring

SB-112 Perimeter soil boring (used in cross-section)

A—A' Approximate cross-section location

Approximate property boundary

NOTES

1. Base map was derived from aerial orthophotos taken 01/17/00.

DAY1/j:/hoover/surffigs/Fig1_ballfieldTM.srf (addblfd.dat) 05/08/00

FIGURE 1

Dogwood Baseball Fields
Subsurface Soil and Groundwater Sampling Locations and Conceptual Cross-Section Location

The Hoover Company, North Canton, Ohio

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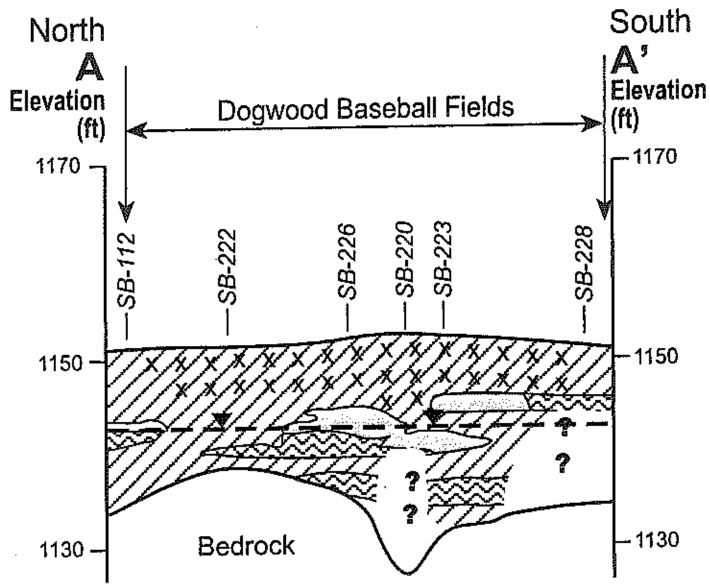

LEGEND

x x x Fill

Coarse-Grained Deposits (sand, gravel, sand & gravel)

Coarse-Grained Deposits with Fines (sand with silt/clay, gravel with silt/clay, sand/gravel with silt/clay)

Fine-Grained Deposits (silt/clay, silt/clay with sand/gravel)

? Unknown

Approximate Groundwater Level

0 200
Horizontal Scale

NOTES:

1. Elevations in feet above mean sea level are based on mean sea level data during 1980's (National Geodetic Vertical Datum of 1988).
2. The depth and thickness of the subsurface strata indicated on the section (profile) were generalized from and interpolated between test borings. Information on actual subsurface conditions exists only at the specific locations and dates indicated. Soil (rock) conditions and water levels at other locations may differ from conditions occuring at the boring locations. Also, the passage of time may result in a change in the conditions at these boring locations.

Figure 2

Dogwood Baseball Fields Investigation
Conceptual Cross-Section A-A'

The Hoover Company, North Canton, Ohio

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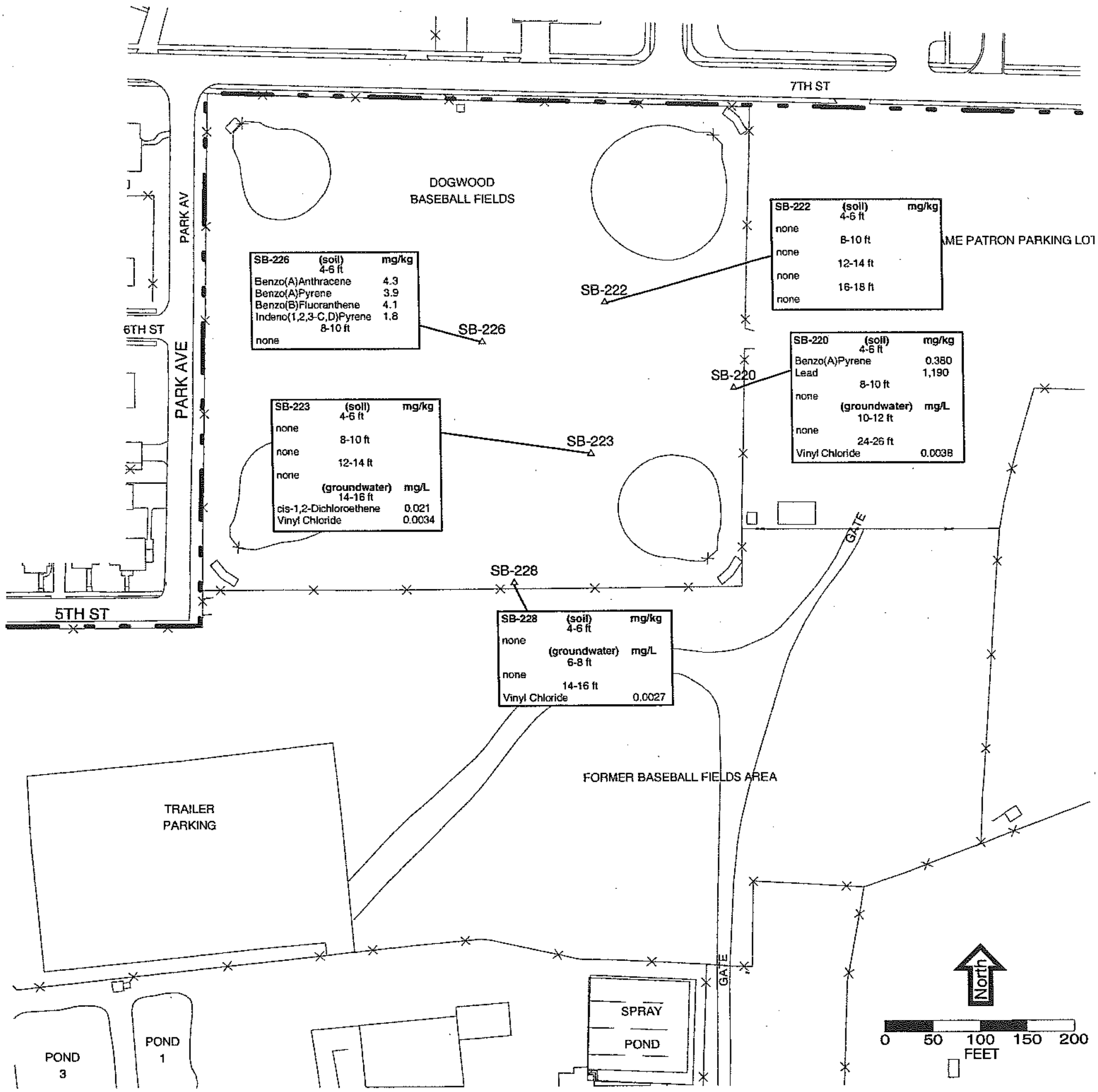

LEGEND

SB-219 △ Ballfield subsurface soil boring

SB-220 14-16 ft Chloride ug/L 0.03	Boring ID, units, sample depth, parameter and analytical result

Approximate property boundary

NOTES
1. Base map was derived from aerial orthophotos taken 01/17/00.
2. All samples were collected February 2000.
3. The analytical results presented here are concentrations higher than facility-specific target levels.

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FIGURE 3
Dogwood Baseball Fields
Subsurface Soil and Groundwater
Analytical Results Above Target Levels
The Hoover Company, North Canton, Ohio
CH2MHILL

Appendix C
Addendum to Preliminary Risk Evaluation

Addendum to the Preliminary Risk Evaluation – Recreational Areas at Hoover Plant 1, North Canton, OH

Summary

A preliminary risk evaluation (CH2M HILL, 2000a) was performed for chemical constituents detected in shallow soil in publicly accessible recreational areas on the northerly portion of The Hoover Company's (Hoover) Plant 1 Facility in North Canton, OH. This preliminary risk evaluation was based on sampling data collected during the Perimeter Investigation (CH2M HILL, 2000b). It concluded that risks from these chemicals in soil fall within the range specified by the U.S. Environmental Protection Agency's (USEPA) risk reduction goal for corrective action. Therefore there are no unacceptable risk to recreational users. The results from this conservative preliminary evaluation also indicate that corrective action (or cleanup) should not be required to reduce risks associated with these chemicals in soil. The preliminary risk evaluation stated that additional sampling would be performed in February 2000 to further evaluate these chemicals in soil. The purpose for the additional sampling was to further evaluate exposure pathways and risk potential for chemicals detected in surface soil, and to understand the vertical extent of constituents (particularly trichloroethene).

This memorandum presents an addendum to the preliminary risk evaluation. The results from that additional surface soil sampling are presented in this memorandum. These additional sampling results were used to update preliminary risk evaluation. The following is a summary of the additional sampling results and the updated preliminary risk evaluation. The results of deep soil samples collected to understand the vertical extent of constituents in soil is not presented in this memorandum, and is documented in the *Dogwood Baseball Fields Subsurface Investigation* (CH2M HILL, 2000c).

Additional soil samples were collected from currently-used baseball fields, and formerly-used ballfields, in February 2000 to better characterize the presence, and concentrations of constituents of interest in surface and shallow soils. These samples were analyzed for constituents of interest identified in the preliminary risk evaluation (polycyclic aromatic hydrocarbons [PAHs], lead, cadmium and trichloroethylene [TCE]):

- PAHs were detected at concentrations over facility-specific target levels in 5 of 13 samples from the 0 to 2 foot interval
- PAHs were detected at concentrations over facility-specific target levels in 2 of 13 samples from the 0 to 6 inch interval
- Lead and TCE were not detected at concentrations over facility-specific target levels in any of the samples.
- Cadmium was not detected in the formerly-used ballfields. This sample was collected from the same location where a previous sample detected cadmium in soil.

The preliminary risk evaluation was updated based on these additional results and conservative assumptions regarding potential exposure scenarios. These additional results confirm that risks from these chemicals in soil in currently-used ballfields fall within an acceptable risk range as defined in the U.S. Environmental Protection Agency (USEPA) risk reduction goal for Corrective Action, and that corrective action (or cleanup) should not be required to reduce risks associated with these chemicals in soil. Cadmium was not detected in the additional sample from the formerly-used ballfields, indicating that this constituent, if present in soil, is likely to be found in a very small area of the formerly-used ballfields. The potential for exposure to cadmium is likely to be very limited.

The addendum to the preliminary risk evaluation is outlined in further detail in the body of this document.

Preliminary Risk Evaluation Process

Soil sampling data collected in November and December 1999 during the Perimeter Investigation (CH2M HILL, 2000b) were used to prepare a preliminary risk evaluation for the publicly accessible recreational areas at the facility (CH2M HILL, 2000a). Additional sampling data were collected in February 2000 from specific areas to confirm the conclusions from the preliminary risk evaluation. These additional data were combined with data collected during the Perimeter Investigation to update the preliminary risk evaluation.

The updated preliminary risk evaluation presented in this addendum consisted of the following steps:

1) Presentation of the soil sampling results, development of appropriate data groups for updating the risk evaluation and calculation of representative concentrations in soil for use in estimating exposure levels and associated health risks
2) Calculation of exposure levels and associated incremental health risks using conservative assumptions. The assumptions and methods used in this step are presented in the preliminary risk evaluation (CH2M HILL, 2000a)
3) Updating the preliminary risk characterization.

Step 1: Sampling and Analysis

Additional sampling and analysis was conducted in the ballfield areas to support two activities:

- An updated risk evaluation of PAHs, TCE and lead in the currently-used baseball fields.
- A reevaluation of cadmium in the former ballfield area.

The sampling and analysis conducted in support of these activities is described below.

Updated Preliminary Risk Evaluation (PAHs, TCE and Lead)

Soil samples were collected in February 2000 from 13 locations within the currently-used baseball fields. At each location, soils samples were collected from surface (0 to 6 inches below ground surface) and near-surface soils (0 to 2 feet below ground surface). Locations for these samples were selected to: 1) bound the area where previous sample results indicated concentrations above facility-specific target levels; and 2) collect samples from exposed soils within the four infield areas. The sample locations are presented in Figure 1. Soil samples were collected from the 0 to 6 inch interval to provide data from soil most accessible to users of the currently-used baseball fields. Four 0 to 6 inch samples collected from the infields (SB-219, SB-221, SB-230 and SB-231). The purpose for this group was to estimate potential exposure in areas with exposed soil (i.e. "bare dirt"). Much of the area in the currently-used baseball fields is covered with turf, which may limit contact with surface soil. The exposed soils within the infield areas are considered to represent the most likely areas for contact with surface soil. Soil samples were collected from the 0 to 2 foot interval to provide data that were comparable with data set collected in November and December 1999. These samples were analyzed for trichloroethylene (TCE), lead and the polycyclic aromatic hydrocarbons (PAHs) benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene and chrysene. All analytical results combined from the November/December 1999 and February 2000 sampling events are presented in Table 1. Constituents detected above facility-specific target levels in samples collected from the 0 to 2 foot interval are presented in Figure 2. The analytical results from the 0 to 6 inch interval in soil are presented in Table 2. Constituents detected above facility-specific target levels in samples collected from the 0 to 6 inch interval are presented in Figure 3.

These data were grouped in order to calculate summary statistics. The summary statistics were used to update the risk evaluation. Methods for grouping samples and developing the summary statistics were consistent with USEPA risk assessment guidelines (USEPA, 1989; USEPA, 1992).

The sample groupings and summary statistics are presented in Table 3. The exposure point concentrations used in the updated preliminary risk evaluation are presented in Table 4.

Re-evaluation of Cadmium in Formerly-Used Ballfields

During the Perimeter Investigation sampling event (November and December 1999), cadmium was detected in one sample from the formerly-used ballfields at a concentration (148 mg/kg) higher than its facility-specific Target Level. However, cadmium was not detected in any of the surrounding samples. The location where cadmium was detected in the former ballfields was resampled in February 2000 to confirm the analytical result from the November/December 1999 sampling event. Cadmium was not detected in the resample. These results indicated that cadmium is likely to be present in only a small portion of the formerly-used ballfields. Therefore, there would be a limited potential for exposure to cadmium in soil. The combined analytical results shown in Table 5 confirms that the occurrence of cadmium, and potential for exposure, is likely to be limited in the formerly-used ballfields. Based on these results, the likelihood of complete exposure pathways to cadmium is small, and cadmium should not represent a potential for significant exposure or health risks. Cadmium in the formerly-used ballfields requires no further evaluation, in this preliminary risk evaluation.

Step 2: Updated Exposure and Risk Evaluation

The preliminary risk evaluation was updated using the exposure point concentrations presented in Table 6. Risks were estimated using exposure scenarios which reflect populations that may come into contact with constituents detected in soil. These exposure scenarios and the associated assumptions are documented in the preliminary risk evaluation memorandum (CH2M HILL, 2000a). The exposure point concentrations presented in Table 4 were the only parameters changed for this updating of the preliminary risk evaluation; all other exposure assumptions are identical to those used to estimate risks with the Perimeter Investigation sampling data collected in November/December 1999. The values for the exposure assumptions are presented in the preliminary risk evaluation memorandum (CH2M HILL, 2000a).

Step 3: Updated Preliminary Risk Characterization

PAHs and TCE

The estimated excess lifetime cancer risk was comparable between the preliminary risk evaluation completed in February 2000 and the updated evaluation presented in this addendum. Risks estimated using the additional data are comparable with or lower than risks estimated with the data collected in November/December 1999. The results from this updated preliminary risk evaluation show that risks from these chemicals in soil fall within the range specified by the U.S. Environmental Protection Agency (USEPA) risk reduction goal for corrective action. In other words, the results from this conservative preliminary evaluation indicate that corrective action (or cleanup) should not be required to reduce risks associated with these chemicals in soil. As shown in Table 6, the estimated excess lifetime cancer risks for each scenario fall within or are lower than the risk range of 1×10^{-6} to 1×10^{-4}, which is the USEPA risk reduction goal for corrective action (USEPA, 1991; USEPA, 1996). Generally, USEPA considers action to be warranted at a site when risks exceed 1×10^{-4}, and action is not typically required for risks falling within 1×10^{-4} to 1×10^{-6}. However, this is judged on a case-by-case basis. Risks less than 1×10^{-6} generally are not of concern to regulatory agencies (USEPA, 1991). Since risks from PAHs and TCE in soil fall within the range specified by USEPA's risk reduction goal, these constituents require no further evaluation, in this preliminary risk evaluation.

Lead

The 95 percent UCL on the average lead concentrations in soil were compared with the 400 mg/kg screening level for lead in residential areas (USEPA, 1994). Comparison of the UCL on the average is considered a reasonably conservative estimate of potential long-term contact with lead in soil (USEPA, 1992). The UCL for lead in soils from 0 to 2 feet was 112 mg/kg, while the UCL for lead in soils from 0 to 6 inches, across all of the ballfields, was 256 mg/kg. The highest concentration of lead in the 0 to 6 inch samples from the exposed soil in the infield areas was 17.6 mg/kg. All of these values are less than the 400 mg/kg screening level. The highest concentration of lead in soil was detected in the December 1999 sampling event. This concentration was 462 mg/kg, which is slightly greater than the 400 mg/kg screening level. This was the only sampling result that was higher than the screening level. However, as discussed in the preliminary risk evaluation (CH2M HILL, 2000a), the UCL is considered a more reasonable estimate of potential long-term contact with lead in soil at the ballfields. Therefore, since the UCLs fall below the screening level, this updated evaluation confirms the conclusion of the preliminary risk evaluation that lead in soil falls below the USEPA screening level of 400 mg/kg (USEPA, 1992; USEPA, 1994). Lead detected in soil in the currently-used ballfields requires no further evaluation, in this preliminary risk evaluation.

Conclusions

Additional sampling data collected in February 2000 from the currently-used baseball fields, and formerly-used ballfields, were used to update a preliminary risk evaluation. The results from this updated preliminary risk evaluation are that concentrations of PAHs, TCE and lead detected in shallow soil in the currently-used baseball fields fall within the target risk range specified by USEPA in its risk reduction goal for corrective action. Cadmium was detected in a single sample from the formerly-used ballfields collected during December 1999. A resample of this location collected in February 2000 did not detect cadmium. The results from sampling in the formerly-used ballfields indicates that the likelihood of complete exposure pathways to cadmium is small, and cadmium should not represent a potential for significant exposure or health risks. Based on this updated preliminary risk evaluation, no remedial actions are warranted.

References

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U.S. Environmental Protection Agency. 1989. *Risk Assessment Guidance for Superfund. Human Health Evaluation Manual Part A, Final.* Office of Solid Waste and Emergency Response. Publication 9285.701.A.

U.S. Environmental Protection Agency. 1992. *Supplemental Guidance to RAGS: Calculating the Concentration Term.* OSWER Publication 9285.7-08

U.S. Environmental Protection Agency. 1994. *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities.* OSWER Directive # 9355.4-12, August 1994.

Table 1

Summary of Analytical Results from Currently-Used Ballfields (Combined December 1999 and February 2000 Sampling Events)

Hoover Perimeter Investigation

December 1999 Sampling Event

Analyte	Units	Sample ID: HVRSB112-1299SN0002 Lab Results	Lab Qualifier	HVRSB113-0100SN0002 Lab Results	Lab Qualifier	HVRSB114-1299SN0002 Lab Results	Lab Qualifier	HVRSB115-1199SN0002 Lab Results	Lab Qualifier	Facility-Specific Target Level Value	Basis
Benzo(A)Anthracene	mg/kg	0.39	U	0.4	U	0.39	U	0.38	U	0.9	RBSL
Benzo(A)Pyrene	mg/kg	0.39	U	0.4	U	0.39	U	0.38	U	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	0.39	U	0.4	U	0.39	U	0.38	U	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	0.39	U	0.4	U	0.39	U	0.38	U	9	RBSL
Chrysene	mg/kg	0.39	U	0.4	U	0.39	U	0.38	U	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	0.39	U	0.4	U	0.39	U	0.38	U	0.9	RBSL
Lead	mg/kg	19.1	=	50.1	=	153	=	17.7	=	400	RBSL
Trichloroethene	mg/kg	0.84	=	0.015	=	0.0046	U	0.0047	U	5	RBSL

Analyte	Units	Sample ID: HVRSB116-1299SN0002 Lab Results	Lab Qualifier	HVRSB117-1299SN0002 Lab Results	Lab Qualifier	HVRSB118-0100SN0002 Lab Results	Lab Qualifier	HVRSB203-1299SN0002 Lab Results	Lab Qualifier	Facility-Specific Target Level Value	Basis
Benzo(A)Anthracene	mg/kg	0.38	U	0.38	U	0.39	U	**1.8**	=	0.9	RBSL
Benzo(A)Pyrene	mg/kg	0.38	U	0.38	U	0.39	U	**1.6**	=	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	0.38	U	0.38	U	0.39	U	**2.1**	=	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	0.38	U	0.38	U	0.39	U	0.79	=	9	RBSL
Chrysene	mg/kg	0.38	U	0.38	U	0.39	U	1.7	=	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	0.38	U	0.38	U	0.39	U	1	=	0.9	RBSL
Lead	mg/kg	14.9	=	24.1	=	66.6	=	59.6	=	400	RBSL
Trichloroethene	mg/kg	0.0044	U	0.0047	U	0.0051	U	5.1	=	5	RBSL

Analyte	Units	Sample ID: HVRSB204-1299SN0002 Lab Results	Lab Qualifier	HVRSB205-1299SN0002 Lab Results	Lab Qualifier	HVRSB206-1299SN0002 Lab Results	Lab Qualifier	HVRSB207-1299SN0002 Lab Results	Lab Qualifier	Facility-Specific Target Level Value	Basis
Benzo(A)Anthracene	mg/kg	**2.5**	=	**3.8**	=	0.37	U	0.38	U	0.9	RBSL
Benzo(A)Pyrene	mg/kg	**2.1**	=	**3.3**	=	0.37	U	0.38	U	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	**3**	=	**4.2**	=	0.37	U	0.38	U	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	1.1	=	1.9	=	0.37	U	0.38	U	9	RBSL
Chrysene	mg/kg	2.6	=	3.7	=	0.37	U	0.38	U	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	1.5	=	2.2	=	0.37	U	0.38	U	0.9	RBSL
Lead	mg/kg	95.5	=	**462**	=	94.3	=	28.2	=	400	RBSL
Trichloroethene	mg/kg	0.0069	=	**6.6**	=	0.0044	U	0.0048	U	5	RBSL

Table 1

Summary of Analytical Results from Currently-Used Ballfields (Combined December 1999 and February 2000 Sampling Events)

Hoover Perimeter Investigation

February 2000 Sampling Event

Analyte	Units	HVRSB219-0200SN000.5 Lab Results	HVRSB219-0200SN000.5 Lab Qualifier	HVRSB219-0200SN0002 Lab Results	HVRSB219-0200SN0002 Lab Qualifier	HVRSB219-0200SD0002 Lab Results	HVRSB219-0200SD0002 Lab Qualifier	HVRSB220-0200SN000.5 Lab Results	HVRSB220-0200SN000.5 Lab Qualifier	Facility-Specific Target Level Value	Facility-Specific Target Level Basis
Benzo(A)Anthracene	mg/kg	0.0059	U	0.30	=	**19.0**	=	0.180	=	0.9	RBSL
Benzo(A)Pyrene	mg/kg	0.0059	U	0.29	=	**18.0**	=	0.170	=	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	0.0059	U	0.36	=	**21.0**	=	0.220	=	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	0.0059	U	0.15	=	**10.0**	=	0.092	=	9	RBSL
Chrysene	mg/kg	0.0059	U	0.26	=	16.0	=	0.170	=	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	0.0059	U	0.18	=	11.0	=	0.110	=	0.9	RBSL
Lead	mg/kg	17.6	=	18.2	=	28.6	=	38.9	=	400	RBSL
Trichloroethene	mg/kg	0.0050	U	0.0047	U	0.0046	U	0.006	U	5	RBSL

Analyte	Units	HVRSB220-0200SN0002 Lab Results	HVRSB220-0200SN0002 Lab Qualifier	HVRSB221-0200SN000.5 Lab Results	HVRSB221-0200SN000.5 Lab Qualifier	HVRSB221-0200SN0002 Lab Results	HVRSB221-0200SN0002 Lab Qualifier	HVRSB222-0200SN000.5 Lab Results	HVRSB222-0200SN000.5 Lab Qualifier	Facility-Specific Target Level Value	Facility-Specific Target Level Basis
Benzo(A)Anthracene	mg/kg	0.099	=	0.0056	U	0.054	U	**2.40**	=	0.9	RBSL
Benzo(A)Pyrene	mg/kg	0.110	=	0.0056	U	0.054	U	**2.30**	=	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	0.130	=	0.0056	U	0.057	=	**2.70**	=	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	0.075	=	0.0056	U	0.054	U	1.50	=	9	RBSL
Chrysene	mg/kg	0.092	=	0.0056	U	0.054	U	2.10	=	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	0.076	=	0.0056	U	0.054	U	1.40	=	0.9	RBSL
Lead	mg/kg	15.5	=	15.6	=	28.70	=	131.00	=	400	RBSL
Trichloroethene	mg/kg	0.0043	U	0.0043	U	0.004	U	0.007	U	5	RBSL

Analyte	Units	HVRSB222-0200SN0002 Lab Results	HVRSB222-0200SN0002 Lab Qualifier	HVRSB223-0200SN000.5 Lab Results	HVRSB223-0200SN000.5 Lab Qualifier	HVRSB223-0200SN0002 Lab Results	HVRSB223-0200SN0002 Lab Qualifier	HVRSB224-0200SN000.5 Lab Results	HVRSB224-0200SN000.5 Lab Qualifier	Facility-Specific Target Level Value	Facility-Specific Target Level Basis
Benzo(A)Anthracene	mg/kg	**3.50**	=	0.90	=	**1.40**	=	0.05	=	0.9	RBSL
Benzo(A)Pyrene	mg/kg	**3.40**	=	**1.00**	=	**1.50**	=	0.05	=	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	**4.30**	=	**1.20**	=	**1.80**	=	0.05	=	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	2.20	=	0.63	=	0.89	=	0.03	=	9	RBSL
Chrysene	mg/kg	2.90	=	0.75	=	1.10	=	0.03	=	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	2.20	=	0.70	=	1.00	=	0.03	=	0.9	RBSL
Lead	mg/kg	50.80	=	28.20	=	32.10	=	160.00	=	400	RBSL
Trichloroethene	mg/kg	0.96	=	0.130	=	0.038	=	0.009	U	5	RBSL

Table 1

Summary of Analytical Results from Currently-Used Ballfields (Combined December 1999 and February 2000 Sampling Events)

Hoover Perimeter Investigation

Analyte	Units	Sample ID								Facility-Specific Target Level	
		HVRSB224-0200SN0002		HVRSB225-0200SN000.5		HVRSB225-0200SN0002		HVRSB226-0200SN000.5			
		Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Value	Basis
Benzo(A)Anthracene	mg/kg	0.870	=	0.040	=	0.006	U	0.073	=	0.9	RBSL
Benzo(A)Pyrene	mg/kg	**0.860**	=	0.053	=	0.007	=	0.088	=	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	**1.10**	=	0.070	=	0.006	=	0.100	=	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	0.420	=	0.028	=	0.006	U	0.057	=	9	RBSL
Chrysene	mg/kg	0.750	=	0.040	=	0.006	U	0.070	=	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	0.550	=	0.041	=	0.006	U	0.063	=	0.9	RBSL
Lead	mg/kg	26.30	=	9.24	=	207.00	=	339.70	=	400	RBSL
Trichloroethene	mg/kg	0.008	U	0.005	U	0.005	U	0.006	U	5	RBSL

Analyte	Units	Sample ID								Facility-Specific Target Level	
		HVRSB226-0200SN0002		HVRSB227-02SN000.5		HVRSB227-0200SN0002		HVRSB227-0200SD0002			
		Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Value	Basis
Benzo(A)Anthracene	mg/kg	**2.90**	=	0.007	U	0.018	=	0.025	=	0.9	RBSL
Benzo(A)Pyrene	mg/kg	**3.00**	=	0.007	U	0.023	=	0.030	=	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	**3.30**	=	0.008	=	0.028	=	0.041	=	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	**1.90**	=	0.007	U	0.012	=	0.021	=	9	RBSL
Chrysene	mg/kg	2.40	=	0.007	U	0.016	=	0.026	=	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	**1.90**	=	0.007	U	0.017	=	0.022	=	0.9	RBSL
Lead	mg/kg	53.20	=	33.10	=	13.90	=	28.90	=	400	RBSL
Trichloroethene	mg/kg	0.007	=	0.006	U	0.025	=	0.008	U	5	RBSL

Analyte	Units	Sample ID								Facility-Specific Target Level	
		HVRSB228-02SN000.5		HVRSB228-0200SN002		HVRSB229-0200SN000.5		HVRSB229-0200SN0002			
		Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Value	Basis
Benzo(A)Anthracene	mg/kg	0.084	=	**2.50**	=	0.046	=	0.150	=	0.9	RBSL
Benzo(A)Pyrene	mg/kg	0.091	=	**2.50**	=	0.056	=	0.170	=	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	0.120	=	**2.80**	=	0.074	=	0.200	=	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	0.061	=	1.80	=	0.032	=	0.098	=	9	RBSL
Chrysene	mg/kg	0.079	=	2.10	=	0.045	=	0.130	=	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	0.065	=	1.60	=	0.043	=	0.110	=	0.9	RBSL
Lead	mg/kg	166.00	=	153.00	=	36.40	=	61.60	=	400	RBSL
Trichloroethene	mg/kg	0.007	U	0.043	=	0.006	U	0.005	U	5	RBSL

Table 1
Summary of Analytical Results from Currently-Used Ballfields (Combined December 1999 and February 2000 Sampling Events)
Hoover Perimeter Investigation

Analyte	Units	Sample ID										Facility-Specific Target Level	
		HVRSB230-0200SN000.5		HVRSB230-0200SN0002		HVRSB231-0200SN000.5		HVRSB231-0200SN0002		HVRSB231-0200SD000.5			
		Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Value	Basis
Benzo(A)Anthracene	mg/kg	0.006	U	0.190	=	0.006	U	0.029	=	0.006	U	0.9	RBSL
Benzo(A)Pyrene	mg/kg	0.006	=	0.210	=	0.006	U	0.039	=	0.006	U	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	0.007	=	0.280	=	0.006	U	0.048	=	0.006	U	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	0.006	U	0.110	=	0.006	U	0.018	=	0.006	U	9	RBSL
Chrysene	mg/kg	0.006	U	0.190	=	0.006	U	0.028	=	0.006	U	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	0.006	U	0.140	=	0.006	U	0.027	=	0.006	U	0.9	RBSL
Lead	mg/kg	10.10	=	9.58	=	8.44	=	10.60	=	140.00	=	400	RBSL
Trichloroethene	mg/kg	0.005	U	0.0075	=	0.005	U	0.005	U	0.005	U	5	RBSL

Notes:
N/A - Not Analyzed
U - Not detected. Value presented is the sample quantitation limit.
= - Detected concentration

Lab results qualified with a "U" are reported at the sample quantitation limit (SQL). The SQL for soil samples is the analytical practical quantitation limit (PQL) adjusted for soil moisture and sample dilution. During the December 1999 sampling event, the laboratory participating on this project has elected to set their soil PQLs for PAHs at 330 ug/kg, (consistent with guidance developed under the USEPA Contract Laboratory Program for Method 8270 analyses) prior to adjustment of individual sample results for soil moisture and dilution. Based on the results of the preliminary risk evaluation, concentrations at the SQL do not represent an unacceptable health risk. Unacceptable health risks could potentially be associated with PAH concentrations above 10 mg/kg.

HVRSB219-0200SD0002 is a field duplicate of HVRSB2196-0200SN0002. High variability in PAH concentrations between these samples may be due to the presence of asphalt in soil. The field log for this sample states that a narrow section (between 0.5 and 0.7 feet in depth) contained gravel with sand and that some of the gravel on this site had an oily sheen to it, which could be the source of PAHs. It is possible that this narrow section of the boring was sampled as the duplicate, but not the native sample.

PAHs in soil samples collected during February 2000 were analyzed using Method 8270SIM, which can obtain lower analytical reporting limits.

Notes on reading sample names:
The sample name can be best understood by breaking it into parts:
HVR(location name)-(month)(year)(media type)(sample type)(sample depth)
For example, a soil sample obtained from 8 to 10 feet below ground from monitoring well location 13 on August 7, 1998, would be designated:
HVRMW013-0898SN0810

Source of Facility-Specific Target Levels:
RBSL - Risk-based screening level, presented in USEPA, 1998 Appendix D.
PQL - Practical Quantitation Limit (PQL in December 1999 samples is higher than the RBSL for benzo(a)pyrene).

Analytical results shown in **bold** were higher than facility-specific target levels.

Table 2

Summary of Analytical Results in Surface Soil (from 0 to 6 inches in depth), Currently-Used Ballfields, Sampled February 2000

Hoover Perimeter Investigation

Analyte	Units	Sample ID								Facility-Specific Target Levels	
		HVRSB219-0200SN000.5		HVRSB220-0200SN000.5		HVRSB221-0200SN000.5		HVRSB222-0200SN000.5			
		Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Value	Basis
Benzo(A)Anthracene	mg/kg	0.0059	U	0.180	=	0.0056	U	**2.40**	=	0.9	RBSL
Benzo(A)Pyrene	mg/kg	0.0059	U	0.170	=	0.0056	U	**2.30**	=	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	0.0059	U	0.220	=	0.0056	U	**2.70**	=	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	0.0059	U	0.092	=	0.0056	U	1.50	=	9	RBSL
Chrysene	mg/kg	0.0059	U	0.170	=	0.0056	U	2.10	=	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	0.0059	U	0.110	=	0.0056	U	1.40	=	0.9	RBSL
Lead	mg/kg	17.6	=	38.9	=	15.6	=	131.00	=	400	RBSL

Analyte	Units	HVRSB223-0200SN000.5		HVRSB224-0200SN000.5		HVRSB225-0200SN000.5		HVRSB226-0200SN000.5		Facility-Specific Target Levels	
		Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Value	Basis
Benzo(A)Anthracene	mg/kg	0.90	=	0.05	=	0.040	=	0.073	=	0.9	RBSL
Benzo(A)Pyrene	mg/kg	**1.00**	=	0.05	=	0.053	=	0.088	=	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	**1.20**	=	0.05	=	0.070	=	0.100	=	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	0.63	=	0.03	=	0.028	=	0.057	=	9	RBSL
Chrysene	mg/kg	0.75	=	0.03	=	0.040	=	0.070	=	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	0.70	=	0.03	=	0.041	=	0.063	=	0.9	RBSL
Lead	mg/kg	28.20	=	160.00	=	9.24	=	339.70	=	400	RBSL

Analyte	Units	HVRSB227-02SN000.5		HVRSB228-02SN000.5		HVRSB229-0200SN000.5		HVRSB230-0200SN000.5		Facility-Specific Target Levels	
		Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Value	Basis
Benzo(A)Anthracene	mg/kg	0.007	U	0.084	=	0.046	=	0.006	U	0.9	RBSL
Benzo(A)Pyrene	mg/kg	0.007	U	0.091	=	0.056	=	0.006	=	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	0.008	=	0.120	=	0.074	=	0.007	=	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	0.007	U	0.061	=	0.032	=	0.006	U	9	RBSL
Chrysene	mg/kg	0.007	U	0.079	=	0.045	=	0.006	U	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	0.007	U	0.065	=	0.043	=	0.006	U	0.9	RBSL
Lead	mg/kg	33.10	=	166.00	=	36.40	=	10.10	=	400	RBSL

Table 2
Summary of Analytical Results in Surface Soil (from 0 to 6 inches in depth), Currently-Used Ballfields, Sampled February 2000
Hoover Perimeter Investigation

Analyte	Units	HVRSB231-0200SN000.5		HVRSB231-0200SD000.5		Facility-Specific Target Levels	
		Lab Results	Lab Qualifier	Lab Results	Lab Qualifier	Value	Basis
Benzo(A)Anthracene	mg/kg	0.006	U	0.006	U	0.9	RBSL
Benzo(A)Pyrene	mg/kg	0.006	U	0.006	U	0.33	PQL
Benzo(B)Fluoranthene	mg/kg	0.006	U	0.006	U	0.9	RBSL
Benzo(K)Fluoranthene	mg/kg	0.006	U	0.006	U	9	RBSL
Chrysene	mg/kg	0.006	U	0.006	U	88	RBSL
Indeno(1,2,3-CD)Pyrene	mg/kg	0.006	U	0.006	U	0.9	RBSL
Lead	mg/kg	8.44	=	140.00	=	400	RBSL

Notes:

N/A - Not Analyzed

U - Not detected. Value presented is the sample quantitation limit.

= - Detected concentration

Lab results qualified with a "U" are reported at the sample quantitation limit (SQL). The SQL for soil samples is the analytical practical quantitation limit (PQL) adjusted for soil moisture and sample dilution. During the December 1999 sampling event, the laboratory participating on this project has elected to set their soil PQLs for PAHs at 330 ug/kg, (consistent with guidance developed under the USEPA Contract Laboratory Program for Method 8270 analyses) prior to adjustment of individual sample results for soil moisture and dilution. Based on the results of the preliminary risk evaluation, concentrations at the SQL do not represent an unacceptable health risk. Unacceptable health risks could potentially be associated with PAH concentrations above 10 mg/kg.

PAHs in soil samples collected during February 2000 were analyzed using Method 8270SIM, which can obtain lower analytical reporting limits.

Notes on reading sample names:
The sample name can be best understood by breaking it into parts:
HVR(location name)-(month)(year)(media type)(sample type)(sample depth)
For example, a soil sample obtained from 8 to 10 feet below ground from monitoring well location 13 on August 7, 1998, would be designated:
HVRMW013-0898SN0810
Source of Facility-Specific Target Levels:
RBSL - Risk-based screening level, presented in USEPA, 1998 Appendix D.
PQL - Practical Quantitation Limit (PQL in December 1999 samples is higher than the RBSL for benzo(a)pyrene).

Analytical results shown in **bold** were higher than facility-specific target levels.

Table 3
Summary Statistics for Constituents of Interest
Hoover Perimeter Investigation

Constituent of Interest	Units	Minimum	Maximum	Mean	Lognormal Mean	Upper Confidence Limit (t-statistic)	Upper Confidence Limit (Land's method)	Distribution
		0-2 Foot Interval (n=25)[1]						
Benzo(A)Anthracene	mg/kg	0.00275	3.8	0.823	1.263	1.22	4.67	Neither normal or lognormal
Benzo(A)Pyrene	mg/kg	0.0069	3.4	0.793	1.041	1.17	3.2	Neither normal or lognormal
Benzo(B)Fluoranthene	mg/kg	0.0064	4.3	0.958	1.25	1.442	3.95	Neither normal or lognormal
Benzo(K)Fluoranthene	mg/kg	0.00275	2.2	0.507	0.743	0.74	2.32	lognormal
Chrysene	mg/kg	0.00275	3.7	0.737	1.12	1.09	3.96	lognormal
Indeno(1,2,3-CD)Pyrene	mg/kg	0.00275	2.2	0.54	0.785	0.78	2.39	Neither normal or lognormal
Trichloroethene	mg/kg	0.00215	6.6	0.547	0.303	1.1	3.74	Neither normal or lognormal
Lead	mg/kg	9.58	462	70.6	67.6	103.5	112.3	lognormal
		0-6 Inch Interval (n=13)[2]						
Benzo(A)Anthracene	mg/kg	0.0028	2.4	0.291	0.453	0.63	16.64	lognormal
Benzo(A)Pyrene	mg/kg	0.0028	2.3	0.295	0.472	0.62	15.52	lognormal
Benzo(B)Fluoranthene	mg/kg	0.0028	2.7	0.351	0.578	0.73	19.19	lognormal
Benzo(K)Fluoranthene	mg/kg	0.0028	1.5	0.188	0.231	0.4	4.99	lognormal
Chrysene	mg/kg	0.0028	2.1	0.254	0.372	0.55	11.71	lognormal
Indeno(1,2,3-CD)Pyrene	mg/kg	0.0028	1.4	0.19	0.272	0.39	6.3	lognormal
Trichloroethene	mg/kg	0.00215	0.13	0.013	0.007	0.03	0.02	Neither normal or lognormal
Lead	mg/kg	8.44	339.7	74.5	80.6	124.9	255.9	lognormal
		0-6 Inch Interval, Infield Area (n=4)[3]						
Benzo(A)Pyrene	mg/kg	0.0028	0.0059	NA	NA	NA	NA	NA
Benzo(B)Fluoranthene	mg/kg	0.0028	0.0074	NA	NA	NA	NA	NA
Lead	mg/kg	8.44	17.6	NA	NA	NA	NA	NA

Notes:
NA - statistic not calculated for data group with small number of samples.

[1] Samples were grouped as follows to calculate these statistics:

SB112	SB117	SB206	SB222	SB227
SB113	SB118	SB207	SB223	SB228
SB114	SB203	SB219	SB224	SB229
SB115	SB204	SB220	SB225	SB230
SB116	SB205	SB221	SB226	SB231

[2] Samples were grouped as follows to calculate these statistics:

SB219	SB222	SB225	SB228	SB231
SB220	SB223	SB226	SB229	
SB221	SB224	SB227	SB230	

[3] Samples were grouped as follows to calculate these statistics:

SB219	SB221	SB230	SB231	

Table 4
Exposure Point Concentrations Used in Updated Preliminary Risk Evaluation
Hoover Perimeter Investigation

Constituent of Interest	Exposure Point Concentration (mg/kg)					
	0 -2 Ft. Interval (a)	Basis	0 - 6 In. Interval (b)	Basis	0 - 6 In. Interval (Infield) (c)	Basis
Benzo(A)Anthracene	1.22	95 UCL (Norm.)	2.4	Maximum	NA	
Benzo(A)Pyrene	1.17	95 UCL (Norm.)	2.3	Maximum	0.0059	Maximum
Benzo(B)Fluoranthene	1.42	95 UCL (Norm.)	2.7	Maximum	0.0074	Maximum
Benzo(K)Fluoranthene	2.2	Maximum	1.5	Maximum	NA	
Chrysene	3.7	Maximum	2.1	Maximum	NA	
Indeno(1,2,3-CD)Pyrene	0.78	95 UCL (Norm.)	1.4	Maximum	NA	
Trichloroethene	1.1	95 UCL (Norm.)	0.03	95 UCL (Norm.)	NA	
Lead	112	95 UCL (Log.)	256	95 UCL (Log.)	17.6	Maximum

(a) - Exposure point concentrations determined using all data for 0 - 2 ft. interval collected from Currently-Used Ballfields Area in 12/99 and 2/00 sampling events
(b) - Exposure point concentrations determined using all data for 0 - 6 in. interval (surface soil) collected from Currently-Used Ballfields Area in 2/00 sampling event.
(c) - Exposure point concentrations determined using data for 0 - 6 in. interval collected from infield locations within the Currently-Used Ballfields during the 2/00 sampling event.
NA - Not applicable (chemical not detected in soil in this area)
95 UCL (Norm.) - Upper 95th percentile confidence limit of the arithmetic mean
95 UCL (Log.) - Upper 95th percentile confidence limit of the log mean
Maximum - Maximum measured value in the dataset.

Table 5
Cadmium Analytical Results in Former Ballfield Area Soil
Hoover Perimeter Investigation

Sample ID	Units	Lab Result	Qualifier
December 1999 Sampling Event			
HVRSB208-1299SN0002	mg/kg	0.609	U
HVRSB209-1299SN0002	mg/kg	0.605	U
HVRSB210-1299SN0002	mg/kg	0.614	U
HVRSB211-1299SN0002	mg/kg	0.606	U
HVRSB212-1299SN0002	mg/kg	0.604	U
HVRSB213-1299SN0002	mg/kg	0.614	U
HVRSB214-1299SN0002	mg/kg	0.596	U
HVRSB215-1299SN0002	mg/kg	0.621	U
HVRSB216-1299SN0002**	mg/kg	**148**	=
HVRSB217-1299SN0002	mg/kg	0.607	U
HVRSB218-1299SN0002	mg/kg	0.654	U
February 2000 Sampling Event			
HVRSB232-0200SN0002**	mg/kg	0.581	U

Notes:
Facility-Specific Target Level for cadmium
is 78 mg/kg
**SB-232 is a resample of from SB216, collected in February 2000.
Cadmium was not detected in soil upon resampling.

Table 6

Updated Preliminary Risk Evaluation Summary (Including 12/99 and 2/00 Surface Soil Data)

Hoover Perimeter Investigation

Summary - Excess Lifetime Cancer Risk

Exposure Scenario	Original Risk Estimates	Updated Risk Estimates		
	0-2 ft. data, collected December 1999	0-2 ft. data, collected December 1999 and February 2000	0-6 in. data, collected February 2000	0-6 in. data, collected from infield areas February 2000
Ballplayer Scenario	8 in 1,000,000	3 in 1,000,000	5 in 1,000,000	2 in 100,000,000
Child Spectator plus Ballplayer Scenario	3 in 100,000	1 in 100,000	2 in 100,000	8 in 100,000,000
Adult Spectator Scenario	6 in 1,000,000	2 in 1,000,000	4 in 1,000,000	1 in 100,000,000

Updated Chemical and Pathway-Specific Risk Estimates

Chemical	Ball Player (0-2 ft. data) (a)			
	Incidental Ingestion	Dermal Contact	Inhalation	Total Risk
Benzo(a)anthracene	1E-07	1E-07		2E-07
Benzo(a)pyrene	9E-07	1E-06		2E-06
Benzo(b)fluoranthene	1E-07	1E-07		2E-07
Benzo(k)fluoranthene	2E-08	2E-08		3E-08
Chrysene	3E-09	3E-09		6E-09
Indeno(1,2,3-cd)pyrene	6E-08	7E-08		1E-07
Trichloroethylene	1E-09	1E-09	3E-08	3E-08
Total				**3E-06**

Chemical	Ball Player (0-6 in. data) (b)			
	Incidental Ingestion	Dermal Contact	Inhalation	Total Risk
Benzo(a)anthracene	2E-07	2E-07		4E-07
Benzo(a)pyrene	2E-06	2E-06		4E-06
Benzo(b)fluoranthene	2E-07	2E-07		5E-07
Benzo(k)fluoranthene	1E-08	1E-08		3E-08
Chrysene	2E-09	2E-09		4E-09
Indeno(1,2,3-cd)pyrene	1E-07	1E-07		2E-07
Trichloroethylene	4E-11	3E-11	7E-10	8E-10
Total				**5E-06**

Chemical	Ballplayer (0-6 in. data - infield only) (c)			
	Incidental Ingestion	Dermal Contact	Inhalation	Total Risk
Benzo(a)anthracene	NA	NA		
Benzo(a)pyrene	8E-09	9E-09		2E-08
Benzo(b)fluoranthene	8E-10	9E-10		2E-09
Benzo(k)fluoranthene	NA	NA		
Chrysene	NA	NA		
Indeno(1,2,3-cd)pyrene	NA	NA		
Trichloroethylene	NA	NA	NA	
Total				**2E-08**

Chemical	Child Spectator plus Ball Player (0-2 ft. data) (a)			
	Incidental Ingestion	Dermal Contact	Inhalation	Total Risk
Benzo(a)anthracene	6E-07	3E-07		8E-07
Benzo(a)pyrene	5E-06	3E-06		8E-06
Benzo(b)fluoranthene	6E-07	3E-07		1E-06
Benzo(k)fluoranthene	9E-08	4E-08		1E-07
Chrysene	2E-08	8E-09		3E-08
Indeno(1,2,3-cd)pyrene	4E-07	2E-07		5E-07
Trichloroethylene	8E-09	3E-09	1E-07	1E-07
Total				**1E-05**

Chemical	Child Spectator plus Ball Player (0-6 in. data) (b)			
	Incidental Ingestion	Dermal Contact	Inhalation	Total Risk
Benzo(a)anthracene	1E-06	5E-07		2E-06
Benzo(a)pyrene	1E-05	5E-06		2E-05
Benzo(b)fluoranthene	1E-06	6E-07		2E-06
Benzo(k)fluoranthene	7E-08	3E-08		1E-07
Chrysene	1E-08	5E-09		1E-08
Indeno(1,2,3-cd)pyrene	6E-07	3E-07		1E-06
Trichloroethylene	2E-10	8E-11	3E-09	4E-09
Total				**2E-05**

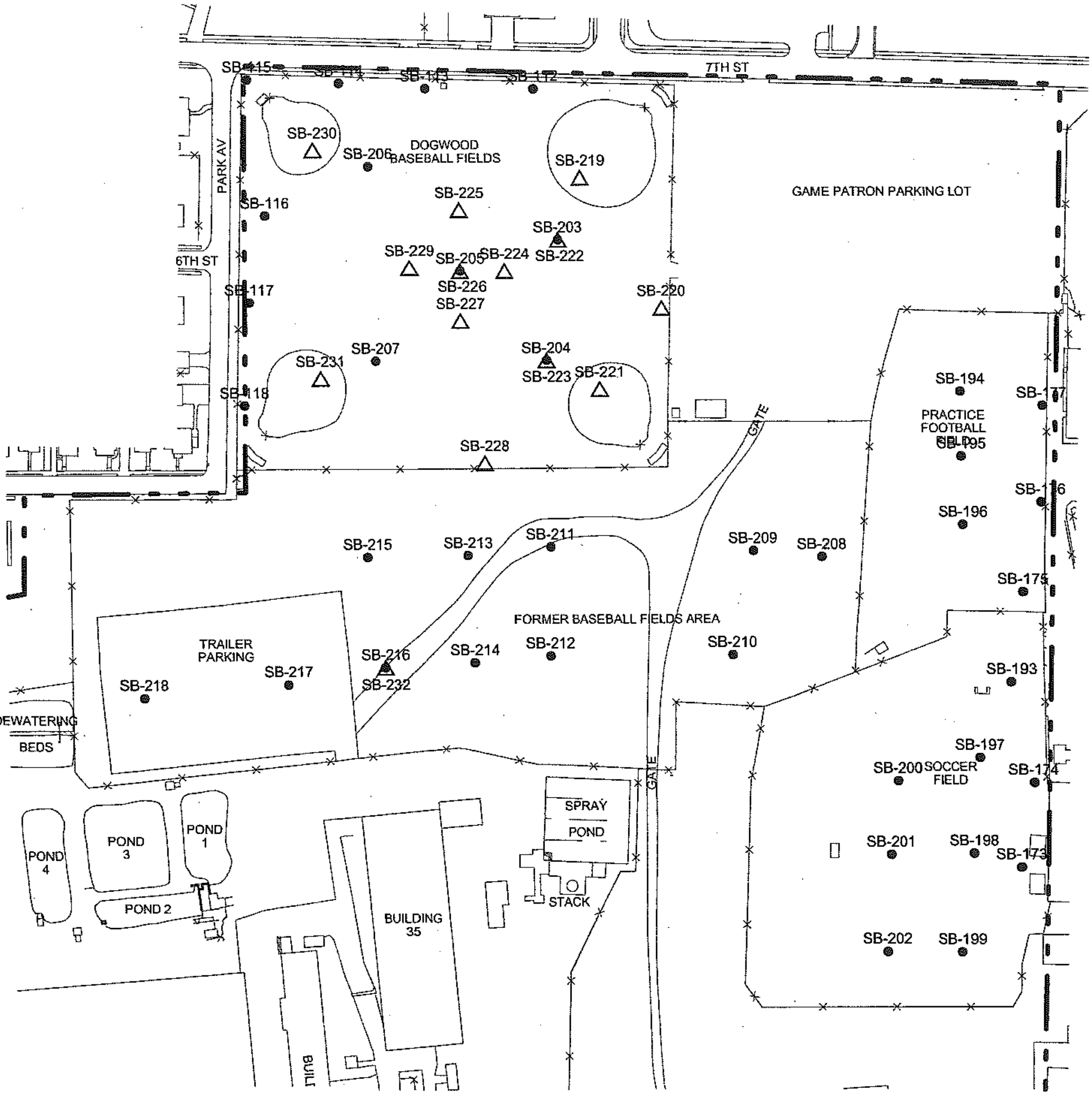
Chemical	Child Spectator plus Ballplayer (0-6 in. data - infield only) (c)			
	Incidental Ingestion	Dermal Contact	Inhalation	Total Risk
Benzo(a)anthracene	NA	NA		
Benzo(a)pyrene	5E-08	2E-08		7E-08
Benzo(b)fluoranthene	5E-09	2E-09		7E-09
Benzo(k)fluoranthene	NA	NA		
Chrysene	NA	NA		
Indeno(1,2,3-cd)pyrene	NA	NA		
Trichloroethylene	NA	NA	NA	
Total				**8E-08**

Table 6
Updated Preliminary Risk Evaluation Summary (Including 12/99 and 2/00 Surface Soil Data)
Hoover Perimeter Investigation

Chemical	Adult Spectator (0-2 ft. data) (a)				Adult Spectator (0-6 in. data) (b)				Adult Spectator (0-6 in. data - infield only) (c)			
	Incidental Ingestion	Dermal Contact	Inhalation	Total Risk	Incidental Ingestion	Dermal Contact	Inhalation	Total Risk	Incidental Ingestion	Dermal Contact	Inhalation	Total Risk
Benzo(a)anthracene	1E-07	5E-08		2E-07	2E-07	1E-07		3E-07	NA	NA		
Benzo(a)pyrene	1E-06	5E-07		2E-06	2E-06	1E-06		3E-06	9E-09	4E-09		1E-08
Benzo(b)fluoranthene	1E-07	6E-08		2E-07	2E-07	1E-07		4E-07	9E-10	4E-10		1E-09
Benzo(k)fluoranthene	2E-08	8E-09		2E-08	1E-08	7E-09		2E-08	NA	NA		
Chrysene	3E-09	2E-09		5E-09	2E-09	9E-10		3E-09	NA	NA		
Indeno(1,2,3-cd)pyrene	7E-08	3E-08		1E-07	1E-07	6E-08		2E-07	NA	NA		
Trichloroethylene	1E-09	6E-10	6E-08	6E-08	4E-11	2E-11	2E-09	2E-09	NA	NA		
Total				**2E-06**				**4E-06**				**1E-08**

(a) - Exposure point concentrations determined using all data for 0 - 2 ft. interval collected from Ballfields Area in 12/99 and 2/00 sampling events
(b) - Exposure point concentrations determined using all data for 0 - 6 in. interval collected from Ballfields Area in 2/00 sampling event.
(c) - Exposure point concentrations determined using data for 0 - 6 in. interval collected from infield locations in 2/00 sampling event.
NA - Not applicable (chemical not detected in soil in this area)

EPA's risk reduction goal is to reduce the threat from carcinogenic contaminants such that the excess lifetime cancer risk falls within a range from 1E-06 to 1E-04 (USEPA, 1996).



LEGEND

SB-203 ● Soil boring (November/December 1999)

△ SB-219 Additional ballfield soil boring (SB-219 through SB-232, February 2000)

▬ ▪ Approximate property boundary

North

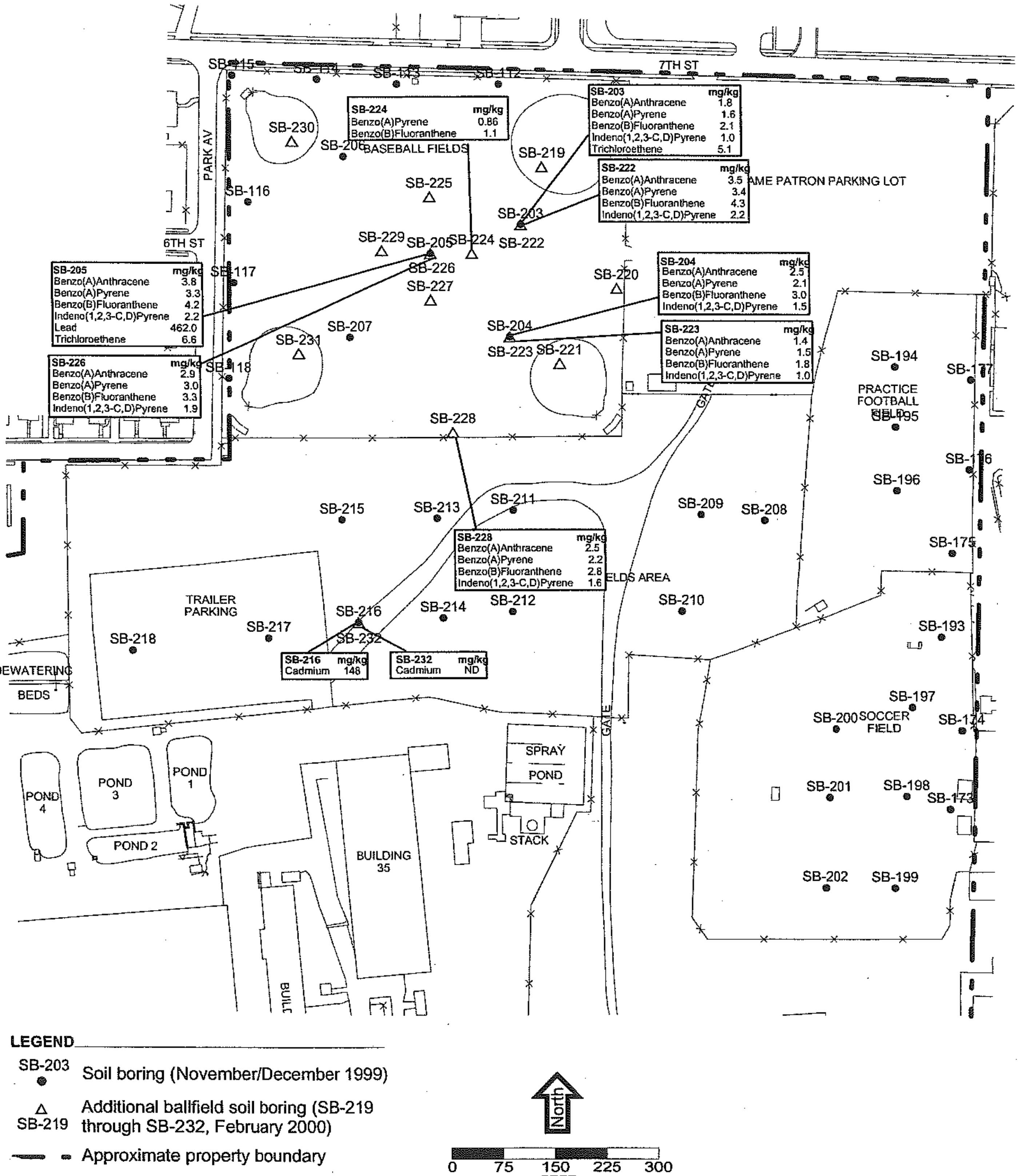
0 75 150 225 300
FEET

NOTES

1. Base map derived from orthographic aerial photos taken January 17, 2000.
2. All samples were collected between November 1999 and February 2000, and results are presented in mg/kg.
3. The analytical results presented here are concentrations higher than facility-specific target levels.

FIGURE 1
Ballfields Surface Soil Sampling Locations
The Hoover Company, North Canton, Ohio
CH2MHILL

DAY1/j:/hoover/surffigs/allballfieldsloconly_ltr.srf (ballfield_survey.txt) 05/11/00



LEGEND

SB-203 Soil boring (November/December 1999)

SB-219 Additional ballfield soil boring (SB-219 through SB-232, February 2000)

Approximate property boundary

OTES

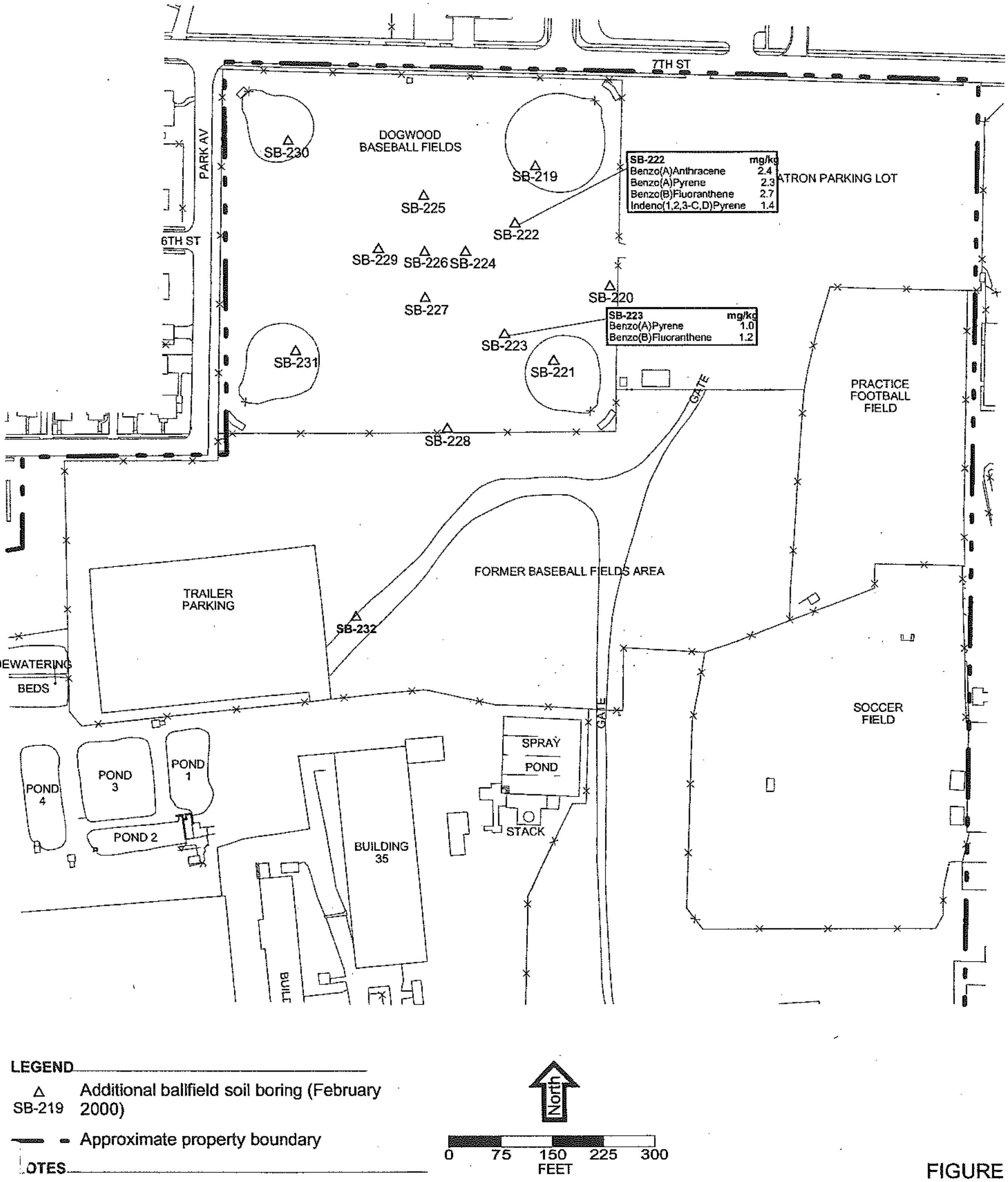
1. Base map derived from orthographic aerial photos taken January 17, 2000.
2. All samples were collected between November 1999 and February 2000, and results are presented in mg/kg.
3. The analytical results presented here are concentrations higher than facility-specific target levels.

DAY1/j:/hoover/surffigs/allballfieldsfeb_ltr.srf (ballfield_survey2.txt) 05/08/00

FIGURE 2
Ballfields Surface Soil (0-2 ft) Sampling Locations

The Hoover Company, North Canton, Ohio

CH2MHILL



LEGEND

△ SB-219 Additional ballfield soil boring (February 2000)

▬ ▪ Approximate property boundary

NOTES

1. Base map derived from orthographic aerial photos taken January 17, 2000.
2. All samples were collected in February 2000, and results are presented in mg/kg.
3. The analytical results presented here are concentrations higher than facility-specific target levels.

FIGURE 3

Ballfields Surface Soil (0-0.5 ft) Sampling Locations

The Hoover Company, North Canton, Ohio

CH2MHILL

DAY1/j:/hoover/surffigs/allballfieldsfebhalffoot_ltr.srf (ALLBLFD5.DAT) 05/08/00